

# **EXPLORATORY ANALYSIS OF RAINFALL DATA IN INDIA FOR AGRICULTURE**

## **NALAIYA THIRAN PROJECT BASED LEARNING On PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP**

### **A PROJECT REPORT**

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## **BACHELOR OF TECHNOLOGY IN INFORMATION TECHNOLOGY**

### **HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY**

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# CHAPTER 1

## INTRODUCTION

Rainfall prediction is helpful to avoid flood which save lives and properties of humans. Moreover, it helps in managing resources of water. Information of rainfall in prior helps farmers to manage their crops better which result in growth of country's economy. Fluctuation in rainfall timing and its quantity makes rainfall prediction a challenging task for meteorological scientists. In all the services provided by meteorological department, Weather forecasting stands out on top for all the countries across the globe. The task is very complex as it requires numbers of specialized and also all calls are made without any certainty. Two widely used methods for rainfall forecasting are: Statistical methods and Numerical Weather Prediction (NWP) model. Nature of rainfall data is non-linear. Frequency, intensity and amount are main characteristics for time series rainfall. These values can be varied from one position on earth to other position of earth and from one time to other time.

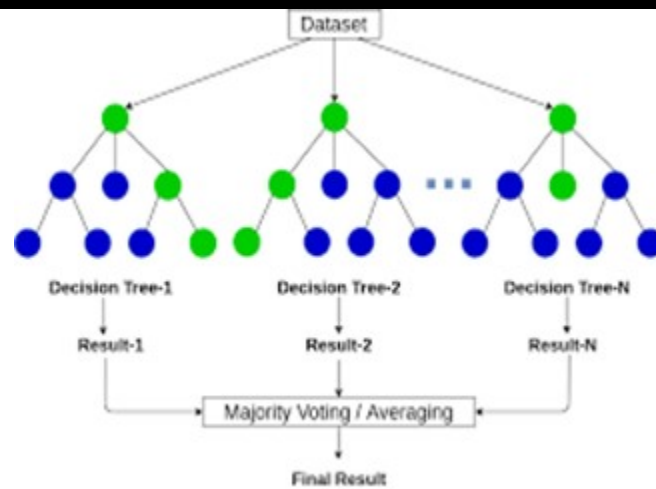
Every statistical model has some drawbacks. On a worldwide scale, large numbers of attempts have been made by different researchers to predict rainfall accurately using various techniques. But due to the nonlinear nature of rainfall, prediction accuracy obtained by these techniques is still below the satisfactory level. Artificial neural network algorithm becomes an attractive inductive approach in rainfall prediction owing to their highly nonlinearity, flexibility and data driven learning in building models without any prior knowledge about catchment behaviour and flow processes.

### 1.1.1 Random forest

Random Forest is a popular machine learning algorithm that belongs to the supervised learning technique. It can be used for both Classification and Regression problems in ML. It is based on the concept of **ensemble learning**, which is a process of *combining multiple classifiers to solve a complex problem and to improve the performance of the model*.

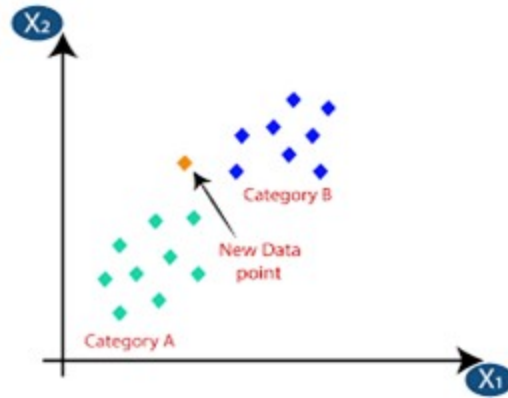
As the name suggests, "**Random Forest is a classifier that contains a number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset.**" Instead of relying on one decision tree, the random forest takes the prediction from each tree and based on the majority votes of predictions, and it predicts the final output. **The greater number of trees in the forest leads to higher accuracy and prevents the problem of overfitting.**

Random forest is used on the job by data scientists in many industries including banking, stock trading, medicine, and e-commerce. It's used to predict the things which help these industries run efficiently, such as customer activity, patient history, and safety.



### 1.1.2 K-Nearest Neighbor(KNN)

- K-Nearest Neighbour is one of the simplest Machine Learning algorithms based on Supervised Learning technique.
- K-NN algorithm assumes the similarity between the new case/data and available cases and put the new case into the category that is most similar to the available categories.
- K-NN algorithm stores all the available data and classifies a new data point based on the similarity. This means when new data appears then it can be easily classified into a well suite category by using K- NN algorithm.
- K-NN algorithm can be used for Regression as well as for Classification but mostly it is used for the Classification problems.
- K-NN is a **non-parametric algorithm**, which means it does not make any assumption on underlying data.
- It is also called a **lazy learner algorithm** because it does not learn from the training set immediately instead it stores the dataset and at the time of classification, it performs an action on the dataset.
- KNN algorithm at the training phase just stores the dataset and when it gets new data, then it classifies that data into a category that is much similar to the new data



### 1.1.3 Xgboost

The XGBoost (eXtreme Gradient Boosting) is a popular and efficient open-source implementation of the gradient boosted trees algorithm. Gradient boosting is a supervised learning algorithm that attempts to accurately predict a target variable by combining an ensemble of estimates from a set of simpler and weaker models. The XGBoost algorithm performs well in machine learning competitions because of its robust handling of a variety of data types, relationships, distributions, and the variety of hyperparameters that you can fine-tune. You can use XGBoost for regression, classification (binary and multiclass), and ranking problems.



## 1.2 Purpose

Rainfall prediction is significant not only on the micro but also on the macro level. The study is of significance with respect to its vital contribution in the field of agriculture, water reserve management, flood prediction and management with an intention to ease the people by keeping them updated with the weather and rainfall prediction. It is also important to be utilized by the agricultural industries for keeping their crops safe and ensure the production of seasonal fruits and vegetables by updated rainfall prediction. The study will also be significant for the flood management authorities as more precise and accurate prediction for heavy monsoon rains will keep the authorities alert and focused for an upcoming event that of which the destruction could be minimized by taking precautionary measures. The rainfall prediction will impressively help in dealing with the increasing issue of water resource management; as water is a scarce resource and it needs to get saved for the benefit of human beings themselves. Also, it will help the people to manage and plan their social activities accordingly. The main aim of this study revolves around providing correct climate description to the clients from various perspectives like agriculture, researchers, generation of power etc. to grasp the need of transformation in climate and its parameters like temperature, humidity, precipitation, wind speed that eventually directs to projection of rainfall. Rainfall also depends on geographic locations hence is an arduous task to predict. Machine Learning is the evolving subset of an AI, that helps in predicting the rainfall. In this research paper, we will be using UCI repository dataset with multiple attributes for predicting the rainfall. The main aim of this study is to develop the rainfall prediction system and predict the rainfall with better accuracy with the use of Machine Learning classification algorithms.

# LITERATURE SURVEY

## 2.1 EXISTING PROBLEM

Rainfall is one of the most complex and difficult elements of the hydrology cycle to understand and to model due to the complexity of the atmospheric processes that generate rainfall and the tremendous range of variation over a wide range of scales both in space and time. Heavy rainfall prediction is a major problem for meteorological department as it is closely associated with the economy and life of human. It is a cause for natural disasters like flood and drought which are encountered by people across the globe every year. Accuracy of rainfall forecasting has great importance for countries like India whose economy is largely dependent on agriculture. Due to dynamic nature of atmosphere, Statistical techniques fail to provide good accuracy for rainfall forecasting. Thus, accurate rainfall prediction is one of the greatest challenges in operational hydrology. On a worldwide scale, large numbers of attempts have been made by different researchers to predict rainfall accurately using various techniques. But due to the nonlinear nature of rainfall, prediction accuracy obtained by these techniques is still below the satisfactory level.

## 2.2 REFERNCES:

### 1. Prediction and Estimation of Rain attenuation of Ka-Band signals

Author: M.R. Sujimol; Rajat Acharya

Year:2019

D.O.I: 10.23919/URSIAP-RASC.2019.8738777

#### Findings:

The received data were preprocessed in which the beacon data and disdrometer data were



synchronized with proper time stamps. The clear sky reference data were defined after and before the rainy days using averaging method. Data from the site at Delhi and Ahmedabad for the year 2016 to 2017 are used for the study here. From the beacon level measurements, the measured attenuation was calculated. The predicted attenuation was calculated using DSD derived Specific attenuation. The plots represent the measured and predicted attenuation in ka band beacons 20.2 GHz (Figure 1). The prediction and scaling algorithm is combined to see the attenuation at other beacon frequency (30.5 GHz) and the result obtained was compared with measured attenuation of 30.5 GHz beacon (Figure 2). The study shows a standard deviation 2.2 dB prediction error.

## **A New Rain Attenuation Prediction Model for the Earth-Space Links**

Author: Chang-Sheng Lu; Zhen-Wei Zhao; Zhen-Sen Wu

Year: 2018

D.O.I: 10.1109/TAP.2018.2854181

### **Findings:**

A new rain attenuation prediction model for the earth-space links is developed. The exponential rain cell profile is first applied to acquire the model structure. Then, the rain rate adjustment factor is introduced where its formula and coefficients are determined and

optimized using the information in the DBSG3 database. It was found that this new model not only provides better prediction results than other existing models over the selected range of percentages of time specified by ITU-R P.311-15 but also over various ranges of latitudes, frequencies and elevation angles. Therefore, the new model can be used to calculate more reliable predicted rain attenuation. This is in fact very useful for the design of satellite communication systems which operating at frequencies higher than 10 GHz.

## **Prediction of Climate Variable using Multiple Linear Regression**

Author: E. Sreehari; Dr.Satyajee Srivastava

Year: 2018

D.O.I: 10.1109/CCAA.2018.8777452

The natural incidents may not possible to stop and cannot estimate in a efficient and accurate manner. In general by using the concept of future estimation concept or events or values there may be a scope to minimize lot of problems. In this project we have implemented the simple regression methodology, multiple regression and we predicted the values, the multiple regression error rate also less when comparing with simple linear regression. Finally concluding that multiple linear regressions can be more better than simple linear regression. By considering vapor pressure value as a dependent variable with other values as independent we successfully implemented the simple linear regression method multiple linear regression. This is the concept of prediction but not in a accurate manner because we know that climate factors changes due to different reasons and impacts on it.

## 2.3 PROBLEM STATEMENT SOLUTION DEFINITION:



Problem Statement	PS1
I am	Farmer
I'm trying to	Planting a crops,harvesting vegetables and fruits and provide a variety of food products humans and animals consumption
But	Due to heavy rainfall or low rainfall crops are gets destroyed
Because	Climate is unpredictable and there is heavy rainfall in recent days due to climate changes
Which makes me feel	Mentally stress and loss of money for farmers. Affect our income and food supply demands

## CHAPTER 3

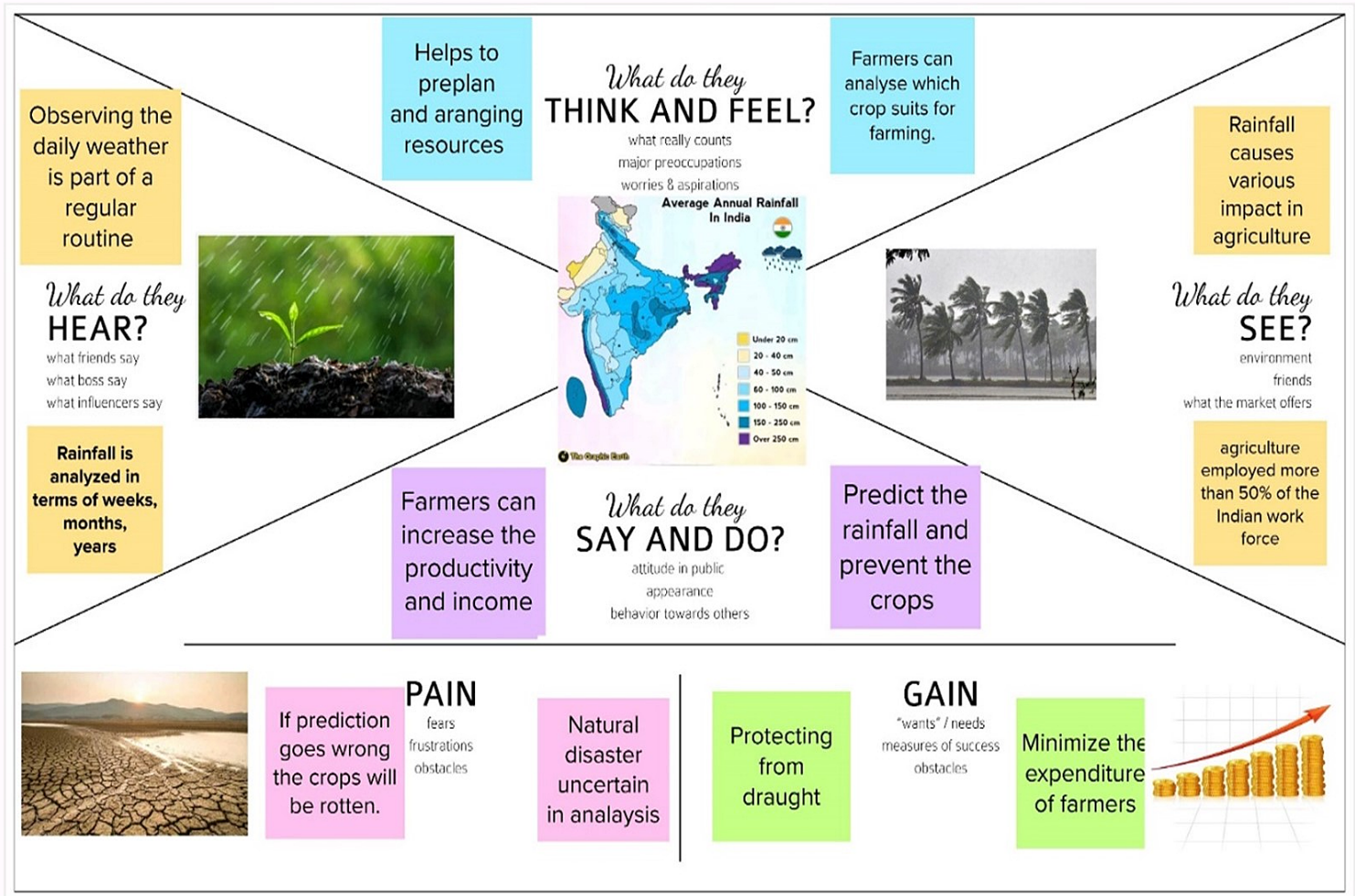
### 3. IDEATION & PROPOSED SOLUTION

#### 3.1 EMPATHY MAP

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from user's perspective along with his or her goals and challenges.

# Empathy Map



## 3.2 IDEATION & BRAINSTORMING

In this activity you are expected to list the ideas (at least 4 per each team member) by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.

1

### Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

⌚ 5 minutes

### Problem Statement

Agriculture is the backbone of the Indian economy. For agriculture, the most important thing is water source, i.e. rainfall. The prediction of the amount of rainfall gives alertness to farmers by knowing early they can protect their crops from rain. So, it is important to predict the rainfall accurately as much as possible. Exploration and analysis of data on rainfall over various regions of India and especially the regions where agricultural works have been done persistently in a wide range. With the help of analysis and the resultant data, future rainfall prediction for those regions using various machine learning techniques such as XGBoost classifier, SVM classifiers, Decision tree, Naive bayes classifier, Logistic regression etc.

2

### Brainstorm

Write down any ideas that come to mind that address your problem statement.

⌚ 10 minutes

#### Allen Joshuva

Technique has full potential to analyze the different aspects of rainfall and consequences related

Increases in atmospheric concentration can have a positive impact on crops yields using data analysis

Data analysis techniques which can be useful for predicting the rainfall which can very useful for taking decisions

Data from a single series should ideally possess property of homogeneity

#### Venkatesan

Reliability to predict rainfall by analyzing the weather data

xgboost classifies the solution

Value with respect to rainfall is frequently zero this is useful for aggregated data

Actual data set used to train the model for performing various actions

### Common Based Ideas

Random Forest Classifier

Visualizing the data, modeling methods, and pre-processing techniques

Stores in pkl format and classifies

Linear regression method

K-Nearest Neighbours

#### Ranjith

Analysing & Predicting rainfall based on seasonal, monthly or annual crop yields

Artificial Neural Network represents

Decision Tree Algorithm

Forecasting months to receive rainfall based on previous years data

#### Subash

Predict the outcome of a new data point

Data Visualization

Actual data set trains the another datasets

Positive correlation between the rainfall and the production

3

### Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

#### Data Analysis Ideas

Data can be estimated using the rainfall data at prediction condition

Data collection & learning the trends present in it

Visualize the rainfall data into time series plot

Data classification technique shows that K-means clustering technique

Observing & noting down daily temperatures

#### Agricultural Purpose [Farmers Satisfaction]

Intensively tends to verical integration

Increases the yield to allow the population growth

Gaining the level of crop that cannot be reduced

Analysis in agriculture are being utilized to scientifically

#### Pattern Recognition

Data Visualization & Collection trends to present it

Understand the news through Indian Metrological Dept.

Watching and analysing the rainfall trends season wise

Collects the time and temperature of various regions & sub-divisions

Focus on increasing the crop yield

#### AI Approaches

##### ML Algorithms

K-Nearest Neighbors

Xgboost Classifiers

Random Forest Algorithm

Decision Tree

NativeBayes Algorithm

##### DL Techniques

SVM

Neural Network Classifiers

4

### Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes





## 3.3 PROPOSED SOLUTION

### Proposed Solution Template:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Human activity is the main reason of climate change that may causes global warming, heavy and low rainfall. This affects the crop growth and health. Rainfall analysis facilitates policy decisions regarding the cropping pattern, sowing date, construction of roads and providing drinking water to urban and rural areas.
2.	Idea / Solution description	<ul style="list-style-type: none"><li>Analysing the rainfall using previous years rainfall data.</li><li>Using this we can forecast the rainfall in upcoming rainfall.</li></ul>
3.	Novelty / Uniqueness	<ul style="list-style-type: none"><li>Predict the Rainfall, Alert the farmer about climatic changes and rainfall level</li><li>Using this rainfall analyse they can prepare for crop cultivation and they can protect their crops.</li></ul>
4.	Social Impact / Customer Satisfaction	<ul style="list-style-type: none"><li>Agriculture employed more than 50% of the Indian work force and contributed 17–18% to country's GDP.</li><li>Agriculture provides employment to over 60% of the population.</li><li>Reduce the poverty in society.</li><li>Increase the income of farmers</li></ul>
5.	Business Model (Revenue Model)	<ul style="list-style-type: none"><li>Increases the food supply</li><li>The share of agriculture in GDP increased to 19.9 per cent in 2020-21 from 17.8 per cent in 2019-2021</li><li>70% of Indian population are engaged in agriculture and raw material for the Industrial sectors</li></ul>
6.	Scalability of the Solution	Rainfall analysis helps the farmers to make them proper planning and pre-arrangement for water resources and increases the crop productivity and income of farmers.

3.4 PROBLEM SOLUTION FIT

Problem Solution Fit

Project Title: Exploratory Analysis of Rainfall Data in India for Agriculture

Team ID: PNT2022TMID10333

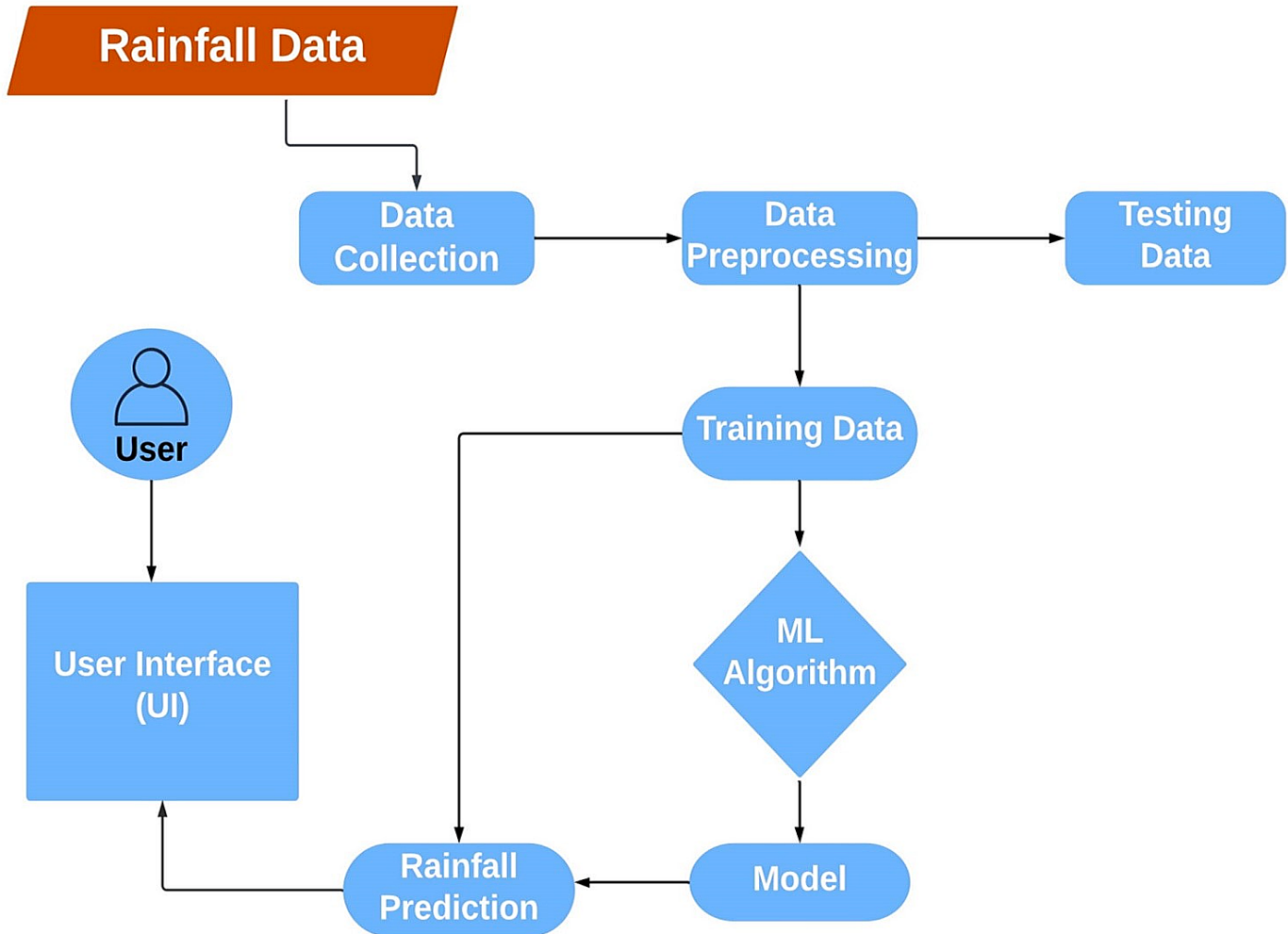
Define CS, fit into CC	<div>1. CUSTOMER SEGMENT(S)<div>CS</div><ul style="list-style-type: none"><li>Farmer</li><li>Common people who are want to know about climatic changes or rainfall</li></ul></div>	<div>6. CUSTOMER CONSTRAINTS<div>CC</div><ul style="list-style-type: none"><li>Decrease food supply demand</li><li>Reduce in damage of crops</li><li>Increase the income</li></ul></div>	<div>5. AVAILABLE SOLUTIONS<div>AS</div><ul style="list-style-type: none"><li>Recommend water irrigation level based on rainfall forecasting</li><li>Rainfall forecasting which will help the farmers to make</li></ul></div>	Define CS, fit into CC
Focus on J&P, tap into BE, understand RC	<div>2. PROBLEMS<div>L&amp;P</div><ul style="list-style-type: none"><li>Burning fossil fuel, deforestations causes the climatic changes</li><li>These climatic changes affect the plant health and growth</li></ul></div>	<div>7. BEHAVIOUR<div>BE</div><ul style="list-style-type: none"><li>Analysis of weather data</li><li>Priority to the climatic changes which spoiling the plans and decisions of farmers</li></ul></div>	<div>9. PROBLEM ROOT CAUSE<div>RC</div><ul style="list-style-type: none"><li>Heavy or low rainfall</li><li>Various factors affecting rainfall such as air pressure, wind direction.</li><li>Sometimes rainfall is unpredictable</li></ul></div>	Focus on J&P, tap into BE, understand RC
Identify strong TR & EM	<div>3. TRIGGERS<div>TR</div><ul style="list-style-type: none"><li>Decrease crops damages</li><li>To generate an innovation in time series forecast rainfall of various types of area</li></ul></div> <div>4. EMOTIONS<div>EM</div><ul style="list-style-type: none"><li>Delight by seeing crops growth well and rate</li><li>Belonging and trust</li></ul></div>	<div>10. YOUR SOLUTION<div>SL</div><ul style="list-style-type: none"><li>Recommending the farmer for correct period for sowing or planting crop to plant</li><li>Trend analysis of rainfall for various areas</li></ul></div>	<div>8. CHANNELS OF BEHAVIOUR<div>CH</div><div>ONLINE</div><div>See the rainfall prediction through online.</div><div>OFFLINE</div><div>Observe the current satiation weather data.</div></div>	Identify strong TR & EM



## 4.2 SOLUTION ARCHITECTURE

Solution architecture is a complex process-with many sub-processes-that bridges the gap between business problem and technology problems and technology solutions. Its goals are to:

1. Find the best tech solution to solve existing business problems.
2. Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
3. Define features, development phases, and solution requirements.
4. Provide specifications according to which the solution is defined, managed, and delivered.



## 4.1 SOLUTION REQUIREMENTS

### Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Registration Form or Google account
FR-2	User Confirmation	Confirmation via Email and OTP
FR-3	User Login	Using the registered email id and password as login credentials
FR-4	Dashboard	Display current rainfall forecasting
FR-5	Rainfall Prediction	Train and predict the rainfall
FR-6	Crop recommendation	Train and recommend the sowing crop based on soil and weather parameter

## 4.2 Non-functional Requirements:

Following are the non-functional requirements of the proposed solution

FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	The Farmer and other people can easily use the application and it is user friendly to prior knowledge is required for using it
NFR-2	<b>Security</b>	Providing secure system requirements and then determine authenticity, originality and security
NFR-3	<b>Reliability</b>	The system will provide the prediction without any errors and failures for a specific time
NFR-4	<b>Performance</b>	Predictions are as same as the true values, so the performance is higher
NFR-5	<b>Availability</b>	Available to different group of farmers for 24/7

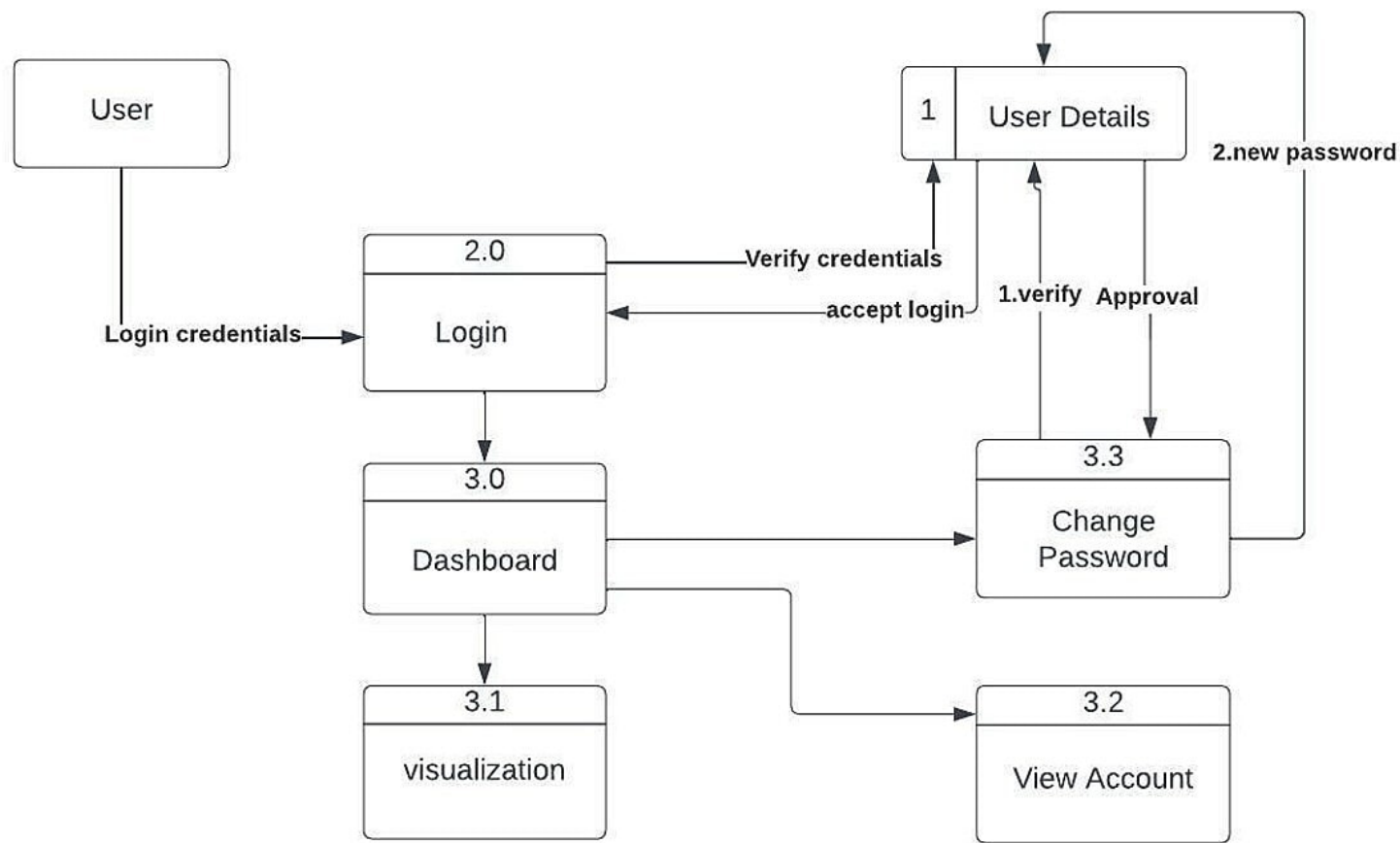
NFR-6	Scalability	The Application should be in the way of adding new functionalities or modules without affecting the existing functionalities
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## 5.PROJECT DESIGN

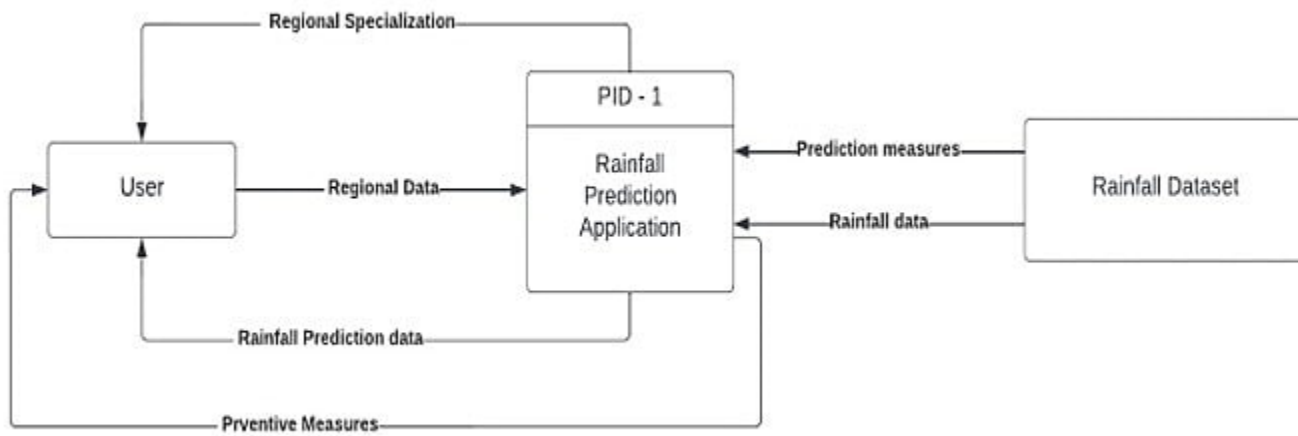
### 5.1 DATAFLOW DIAGRAMS

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

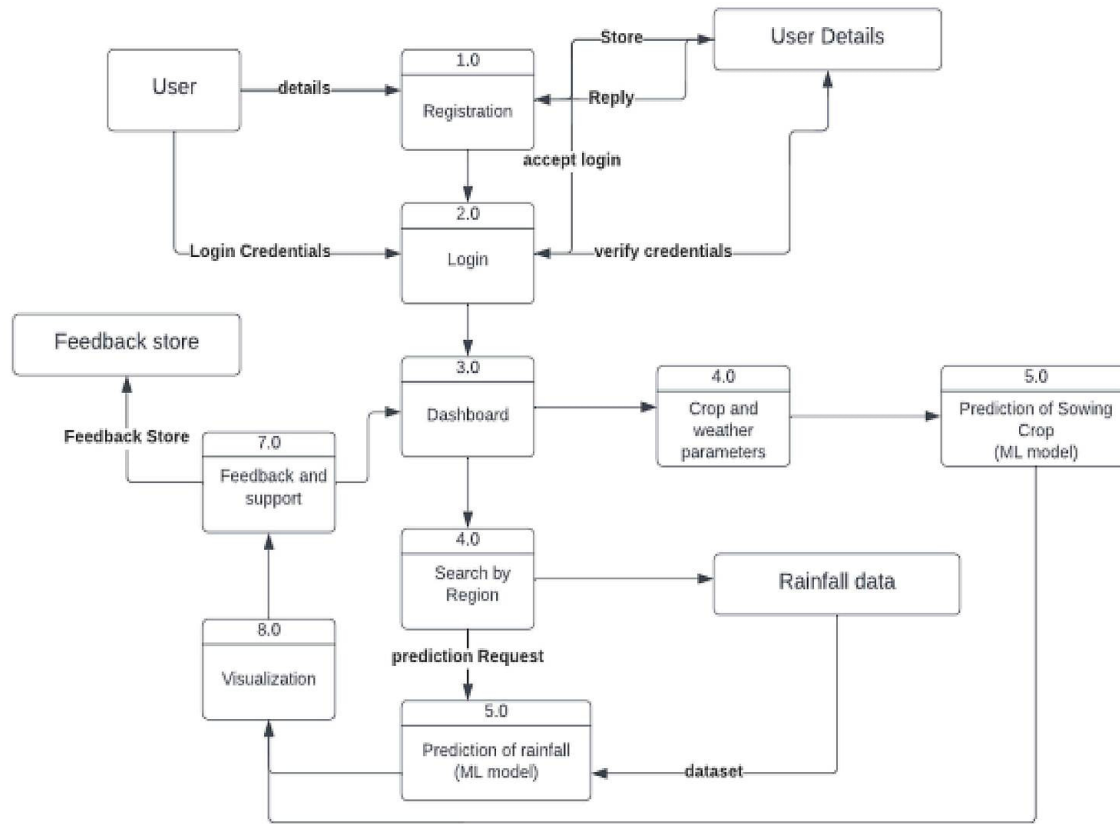
**Data Flow Diagram level-0:**



## Data Flow Diagram level-1:



## Data Flow Diagram level-2:



## User Stories

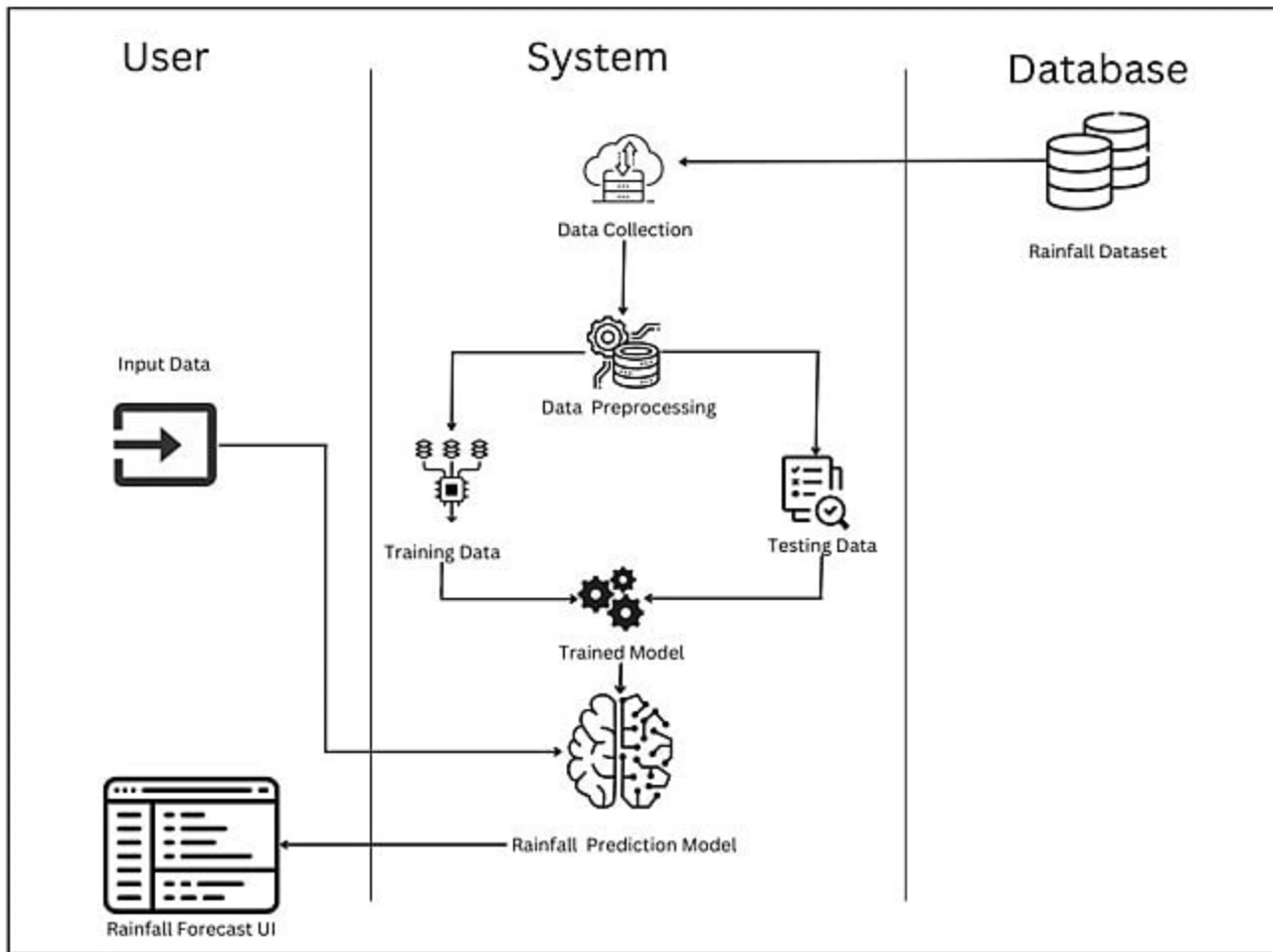
User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Registration	USN-1	As a user, I can register for the application by entering my email, password, and verify my password.	I can access my account / dashboard	High	Sprint-2
		USN-2	As a user, I will receive verification email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-2
		USN-3	As a user, I can register for the application through Google Account OR any other account	I can register & access the dashboard with google	Low	Sprint-2
	Login	USN-4	As a user, I can log into the application by entering email & password	Registered username or email and password	High	Sprint-2
	Dashboard	USN-5	As a user, I can monitor or analysis the current rainfall forecasting	Location and date	Medium	Sprint-3

	Rainfall Prediction	USN-6	As a user, I can enter the input data to predict the rainfall	Location and date	High	Sprint-3
	Crop Suggestion	USN-7	As a user, I can enter the soil and weather parameter to predict the crop for cultivation	Soil and weather parameter	High	Sprint-3

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer Care Executive	Contact	USN-8	As a user, I can ask queries regarding the system	I can clarify my doubts	Medium	Sprint-4
	Feedback	USN-9	As a user, I can send feedback and queries to the Administrator	I can review the application and suggest updates	Low	Sprint-4
Administrator	Login	USN-10	As a Administrator, I can login to the application by entering my email, password, and confirming my password	I can view and update the system	High	Sprint-1
	Rainfall Prediction Model	USN-11	As a administrator, I train the rainfall prediction model and save the best model	I train the rainfall prediction Model	High	Sprint-1

## 5.4 TECHNOLOGY STACK

### TECHNICAL ARCHITECTURE:



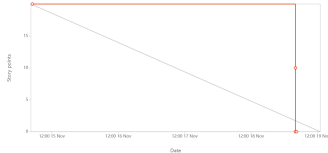
**Table-1 : Components & Technologies:**

S.No	Component	Description	Technology
1.	User Interface	User interacts with application by Web UI	HTML, CSS, Bootstrap, JavaScript
2.	Application Logic-1	Integrate website with machine learning	Flask, Python
3.	Application Logic-2	Forecasting rainfall	Machine learning
4.	Application Logic-3	Cloud Application Server	IBM Watson STT service
5.	Database	Data Type, Configurations etc.	MySQL, Pickle, etc



6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	External API	Accessing current climate data	IBM Weather API, etc.
8.	Machine Learning Model	Forecasting rainfall and crop recommending	Rainfall Model, Crop Recommending Model.

**Table-2: Application Characteristics:**

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Open-source frameworks used	Python, Flask, Pickle, Machine learning
2.	Security Implementations	Request authentication using JWT Tokens	HS-256, Encryptions,  SSL Certs
3.	Scalable Architecture	Support for Multiple Sample prediction	Pandas, Numpy , Scipy, Scikit-learn
4.	Availability	Availability is increased by Distributed Servers in Cloud VPS	IBM Cloud
5.	Performance	The application is expected to handle multiple predictions per second	Load Balancers, Distributed Server

## 6.2 SPRINT DELIVERY SCHEDULE

### Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Rainfall Prediction Model	USN-1	Collecting weather dataset, data preprocessing the data and do a data visualization	5	High	Ranjith, Venkatesan
Sprint-1		USN-2	Train rainfall Prediction model using different machine learning algorithms	5	Medium	Allen joshuva, Ranjith
Sprint-1		USN-3	Test the best model and save best model by pickle library	5	High	Allen joshuva, Venkatesan
Sprint-1		USN-4	Train crop recommendation model using different machine learning algorithms	5	Medium	Allen joshuva, Ranjith
Sprint-1		USN-5	Test the best model and save best model by pickle library	5	High	Ranjith, Venkatesan
Sprint-2	Registration	USN-6	User can register for the application by entering his or her email, password, and confirming the password.	5	Medium	Ranjith, Subash

<b>Sprint</b>	<b>Functional Requirement (Epic)</b>	<b>User Story Number</b>	<b>User Story / Task</b>	<b>Story Points</b>	<b>Priority</b>	<b>Team Members</b>
Sprint-2		USN-7	User will receive confirmation email or message once registered for the application	5	Low	Venkatesan, Subash
Sprint-2	Login	USN-8	Enter the username and password to login to the application	5	Medium	Allen joshuva, Venkatesan
Sprint-2		USN-9	The existing credentials should be used for login on multiple systems	5	Medium	Venkatesan, Subash
Sprint-2	Dashboard	USN-10	Forecast the today weather	10	Low	Subash, Ranjith
Sprint-3	Rainfall Prediction	USN-11	User can enter the weather parameters like min temp, max temp, etc	5	High	Allen joshuva, Venkatesan
Sprint-3		USN-12	Predict the rainfall and display the result	5	High	Venkatesan, Subash
Sprint-3		USN-13	Predict the sowing crop and display the result	5	High	Venkatesan, Subash
Sprint-4	Testing	USN-14	Test the application	10	High	Ranjith, Allen joshuva
Sprint-4	Deploy Model	USN-15	deploy the model in IBM cloud to make user friendly application	10	High	Venkatesan, Ranjith

Project Tracker, Velocity & Burndown Chart:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	30	6 Days	24 Oct 2022	29 Oct 2022	30	30 Oct 2022
Sprint-2	30	6 Days	31 Oct 2022	05 Nov 2022	30	06 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	13 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	20 Nov 2022

Velocity:






















We have a 6-day sprint duration, and the velocity of the team is 20 to 30 (points per sprint). Let’s calculate the team’s average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity}$$

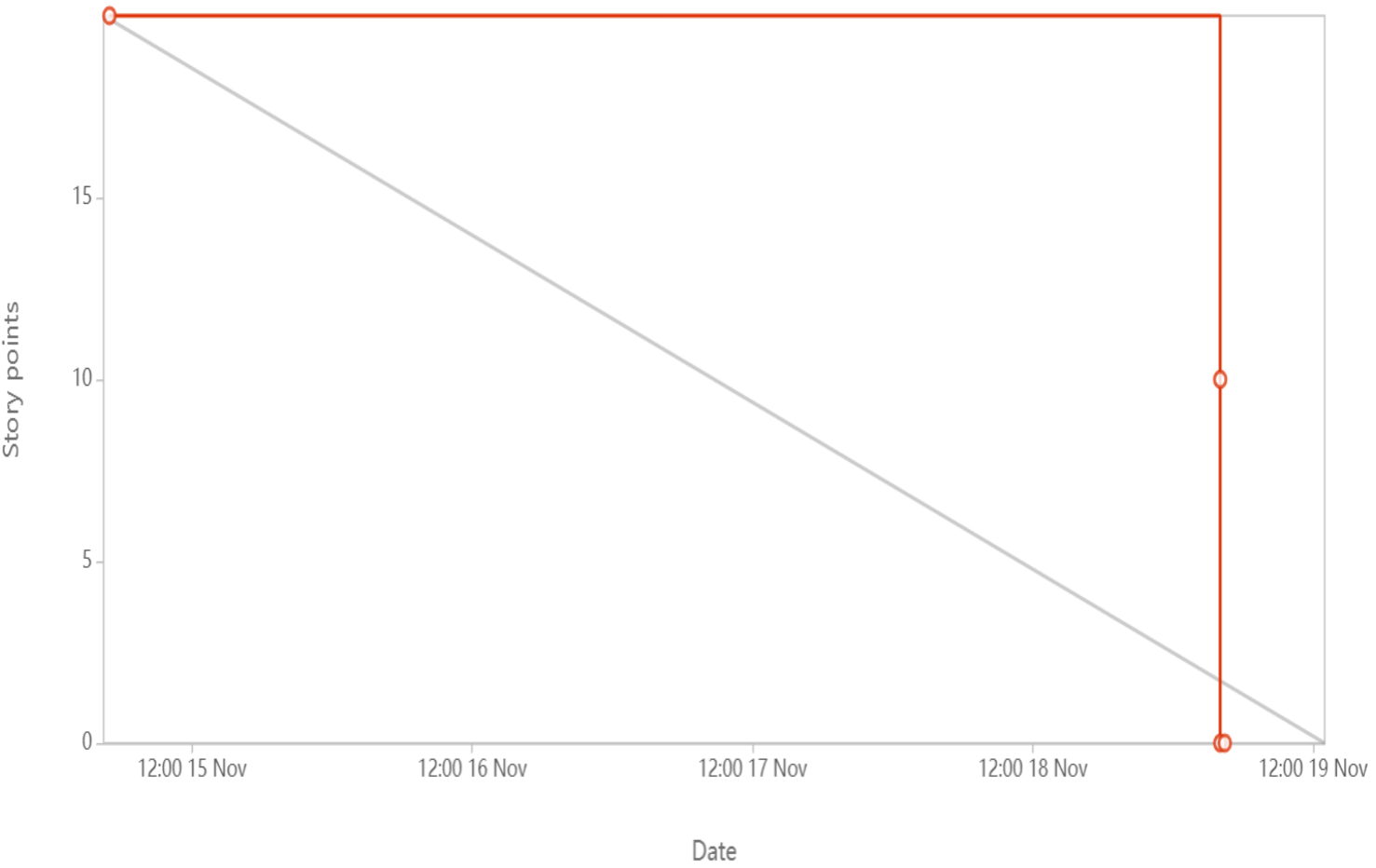
Sprint	Average Velocity
Sprint -1	5
Sprint-2	5
Sprint-3	3.33
Sprint-4	3.33

Total Average Velocity = 4.16

# RoadMap

		OCT								NOV								NOV															
		23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Sprints		AL Sprint 1								AL Sprint 2								AL Sprint 3								AL Sprint 4							
▼  AL-8 Rainfall Prerdiction Model																																	
 AL-10 Data collection	TO DO																																
 AL-11 Data Preprocessing	TO DO																																
 AL-12 Data visualization	TO DO																																
 AL-13 train Rainfall Prediction Model	TO DO																																
 AL-14 Test the Model	TO DO																																
 AL-15 Save the Model	TO DO																																
▼  AL-16 Registration																																	
 AL-17 Registration Page	TO DO																																
 AL-18 User Authentication	TO DO																																
▼  AL-19 Login																																	
 AL-21 Login page	TO DO																																
 AL-22 User Authentication	TO DO																																
▶  AL-23 DashBoard																																	
▼  AL-25 Rainfall Prediction																																	
 AL-26 Rainfall Prediction Page	TO DO																																
 AL-28 Predicted Result Page	TO DO																																
▼  AL-29 Testing																																	
 AL-30 Testing the Application	TO DO																																
▼  AL-31 Deploy Model																																	
 AL-33 Deploy Model in IBm cloud	TO DO																																

BURNDOWN CHART



## 7.CODING & SOLUTIONING (Explain the features added in the project along with code)

### 7.1 Feature 1

#### Machine Learning

```
knn_model = KNeighborsClassifier()

knn_model.fit(X_train, y_train)

knn_model.predict(X_val)

knn_model_score = knn_model.score(X_val, y_val)

knn_model_accuracy = round(knn_model_score*100, 2)

print("The classification accuracy of KNN model is "+ str(knn_model_accuracy)+"%")

y_pred = knn_model.predict(X_val)

cm = confusion_matrix(y_val,y_pred)

axes = sns.heatmap(cm, annot=True, annot_kws={"size": 16}, fmt='g', linewidths=.5)

class_labels = ['Not Rain', 'Rain']

axes.set_xlabel('Predicted', fontsize=12)

axes.set_ylabel('Actual', fontsize=12)

xtick_marks = np.arange(len(class_labels)) + 0.5

ytick_marks = np.arange(len(class_labels)) + 0.5

axes.set_xticks(xtick_marks)

axes.set_xticklabels(class_labels, rotation=45)

axes.set_yticks(ytick_marks)

axes.set_yticklabels(class_labels, rotation=0)

axes.set_title('KNN Confusion Matrix', fontsize=14, pad=20)

plt.show()

print('KNN Classification Report')

print(classification_report(y_val, y_pred, target_names=class_labels))


dtree_model = DecisionTreeClassifier()
```

```
dtree_model.fit(X_train, y_train)

dtree_model.predict(X_val)

dtree_model_score = dtree_model.score(X_val, y_val)

dtree_model_accuracy = round(dtree_model_score*100, 2)

print("The classification accuracy of Decision Tree model is "+ str(dtree_model_accuracy)+"%")

y_pred = dtree_model.predict(X_val)

cm = confusion_matrix(y_val,y_pred)

axes = sns.heatmap(cm, annot=True, annot_kws={"size": 16}, fmt='g', linewidths=.5)

class_labels = ['Not Rain', 'Rain']

axes.set_xlabel('Predicted', fontsize=12)

axes.set_ylabel('Actual', fontsize=12)

xtick_marks = np.arange(len(class_labels)) + 0.5

ytick_marks = np.arange(len(class_labels)) + 0.5

axes.set_xticks(xtick_marks)

axes.set_xticklabels(class_labels, rotation=45)

axes.set_yticks(ytick_marks)

axes.set_yticklabels(class_labels, rotation=0)

axes.set_title('Decision Tree Confusion Matrix', fontsize=14, pad=20)

plt.show()

print('Decision Tree Classification Report')

print(classification_report(y_val, y_pred, target_names=class_labels))


adaboost_model = AdaBoostClassifier()

adaboost_model.fit(X_train, y_train)

adaboost_model.predict(X_val)

adaboost_model_score = adaboost_model.score(X_val, y_val)

adaboost_model_accuracy = round(adaboost_model_score*100, 2)

print("The classification accuracy of XGBoost model is "+ str(adaboost_model_accuracy)+"%")

y_pred = adaboost_model.predict(X_val)
```



```
cm = confusion_matrix(y_val,y_pred)
axes = sns.heatmap(cm, annot=True, annot_kws={"size": 16}, fmt='g', linewidths=.5)
class_labels = ['Not Rain', 'Rain']
axes.set_xlabel('Predicted', fontsize=12)
axes.set_ylabel('Actual', fontsize=12)
```

```
xtick_marks = np.arange(len(class_labels)) + 0.5
ytick_marks = np.arange(len(class_labels)) + 0.5
axes.set_xticks(xtick_marks)
axes.set_xticklabels(class_labels, rotation=45)
axes.set_yticks(ytick_marks)
axes.set_yticklabels(class_labels, rotation=0)
axes.set_title('XGBoost Confusion Matrix', fontsize=14, pad=20)
plt.show()
print('XGBoost Classification Report')
print(classification_report(y_val, y_pred, target_names=class_labels))
```

```
rforest_model = RandomForestClassifier()
rforest_model.fit(X_train, y_train)
rforest_model.predict(X_val)
rforest_model_score = rforest_model.score(X_val, y_val)
rforest_model_accuracy = round(rforest_model_score*100, 2)
print("The classification accuracy of Random Forest model is "+ str(rforest_model_accuracy)+"%")
y_pred = rforest_model.predict(X_val)
cm = confusion_matrix(y_val,y_pred)
axes = sns.heatmap(cm, annot=True, annot_kws={"size": 16}, fmt='g', linewidths=.5)
class_labels = ['Not Rain', 'Rain']
axes.set_xlabel('Predicted', fontsize=12)
axes.set_ylabel('Actual', fontsize=12)
```

```

xtick_marks = np.arange(len(class_labels)) + 0.5
ytick_marks = np.arange(len(class_labels)) + 0.5
axes.set_xticks(xtick_marks)
axes.set_xticklabels(class_labels, rotation=45)
axes.set_yticks(ytick_marks)
axes.set_yticklabels(class_labels, rotation=0)
axes.set_title('Random Forest Confusion Matrix', fontsize=14, pad=20)
plt.show()
print('Random Forest Classification Report')
print(classification_report(y_val, y_pred, target_names=class_labels))

```

## 7.2 Feature 2

### Connect with MySQL

```

mydb = mysql.connector.connect(
    host="localhost",
    user="root",
    password="",
    charset="utf8",
    database="rainfall_prediction"
)

#Login
def login():
    msg=""

    if request.method=='POST':
        uname=request.form['uname']
        pwd=request.form['pass']
        cursor = mydb.cursor()
        cursor.execute('SELECT * FROM rf_register WHERE uname = %s AND pass = %s', (uname, pwd))

```

```
account = cursor.fetchone()

if account:

    session['username'] = uname

    return redirect(url_for('test_data'))

else:

    msg = 'Incorrect username/password!'

return render_template('login.html',msg=msg)
```

## #Registration

```
def register():

    msg=""

    act=request.args.get("act")

    if request.method=='POST':

        name=request.form['name']

        location=request.form['location']

        mobile=request.form['mobile']

        email=request.form['email']

        uname=request.form['uname']

        pass1=request.form['pass']

        mycursor = mydb.cursor()

        now = datetime.datetime.now()

        rdate=now.strftime("%d-%m-%Y")

        mycursor.execute("SELECT count(*) from rf_register where uname=%s",(uname,))

        cnt = mycursor.fetchone()[0]

        if cnt==0:

            mycursor.execute("SELECT max(id)+1 FROM rf_register")

            maxid = mycursor.fetchone()[0]

            if maxid is None:
```

```
maxid=1
```

```
sql = "INSERT INTO rf_register(id,name,location,mobile,email,uname,pass,create_date) VALUES (%s, %s, %s, %s, %s, %s, %s, %s)"
```

```
val = (maxid,name,location,mobile,email,uname,pass1,rdate)
```

```
mycursor.execute(sql, val)
```

```
mydb.commit()
```

```
#print(mycursor.rowcount, "Registered Success")
```

```
msg="sucess"
```

```
#if mycursor.rowcount==1:
```

```
return redirect(url_for('register',act='1'))
```

```
else:
```

```
msg='User Already Exist!'
```

```
return render_template('register.html',msg=msg,act=act)
```

## **Sprint4**

### **Test Result**

```
def test_data():
```

```
act=""
```

```
res=""
```

```
uname=""
```

```
if 'username' in session:
```

```
    uname = session['username']
```

```
if uname is None:
```

```
    return redirect(url_for('login'))
```

```
mycursor = mydb.cursor()
```

```
mycursor.execute("SELECT * FROM rf_register where uname=%s",(uname,))
```

```
data = mycursor.fetchone()
```

```
name=data[1]
```

```
if request.method=='POST':
```

```
    min_temp=request.form['min_temp']
```

```
max_temp=request.form['max_temp']
rain=request.form['rain']
gust_dir=request.form['gust_dir']
gust_speed=request.form['gust_speed']
hum1=request.form['hum1']
hum2=request.form['hum2']
pres1=request.form['pres1']
pres2=request.form['pres2']
temp1=request.form['temp1']
temp2=request.form['temp2']
df = pd.read_csv("static/dataset/weather_test.csv")
x=0
mt=float(min_temp)
mx=float(max_temp)
rain1=float(rain)
for rr in df.values:
    if rr[2]>mt1 and rr[2]<=mt2 and rr[3]>mx1 and rr[3]<=mx2 and rr[4]>r1 and rr[4]<=r2 and rr[7]==gust_dir and
rr[8]>gs1 and rr[8]<=gs2:
        if rr[13]>hm1 and rr[13]<=hm2 and rr[14]>hm3 and rr[14]<=hm4 and rr[15]>pr1 and rr[15]<=pr2 and
rr[16]>pr3 and rr[16]<=pr4:
            if rr[19]>tm1 and rr[19]<=tm2 and rr[20]>tm3 and rr[20]<=tm4:
                x+=1
print(x)
act="1"
if x>0:
    res="Yes"
else:
    res="No"
```

## 8. TESTING

### 8.1 TEST CASE

#### POSITIVE TESTCASE

TESTCASE ID	Tc_1
TESTCASE LABEL	UI panel
TESTCASE EXPLANATION	Values of the different parameters need to be entered by the user.
INPUT GIVEN	User enters the value of the parameter with one value missing.
EXPECTED OUTPUT	Corresponding to the values entered the model must predict the rainfall.
ACTUAL OUTPUT	The rainfall value will not be obtained due to the missing parameter.
TESTCASE STATUS	Failure.

TESTCASE ID	Tc_2
TESTCASE LABEL	UI panel
TESTCASE EXPLANATION	Values of the different parameters need to be entered by the user.
INPUT GIVEN	User enters the value of the parameter.
EXPECTED OUTPUT	Corresponding to the values entered the model must predict the rainfall.
ACTUAL OUTPUT	The rainfall value will be obtained.
TESTCASE STATUS	Success.

TESTCASEID	Tc_3
TESTCASELABEL	UI panel
TESTCASEEXPLANATION	Selectionof the modeleither ANN or SVM.
INPUT GIVEN	User mustselect the modelfrom dropdown.
EXPECTEDOUTPUT	Corresponding to the modelselected the model mustpredict the rainfall.
ACTUAL OUTPUT	The rainfall valuewill be obtained.
TESTCASESTATUS	Success.

## NEGATIVE TESTCASE

TESTCASEID	Tc_4
TESTCASELABEL	UI panel
TESTCASEEXPLANATION	Selectionof the modeleither ANN or SVM.
INPUT GIVEN	User does notselect the modelfrom dropdown.
EXPECTEDOUTPUT	Corresponding to the modelselected the model mustpredict the rainfall.
ACTUAL OUTPUT	The rainfall valuewill not be obtained.
TESTCASESTATUS	Failure.

TESTCASEID	Tc_5
TESTCASELABEL	Trainingmodel

TESTCASEEXPLANATION	Setting the training and test size of the dataset.
INPUT GIVEN	User must select a larger percent of train dataset and smaller percent of test dataset.
EXPECTEDOUTPUT	The model will be successfully trained and tested.
ACTUAL OUTPUT	The model is successfully saved.
TESTCASESTATUS	Success.

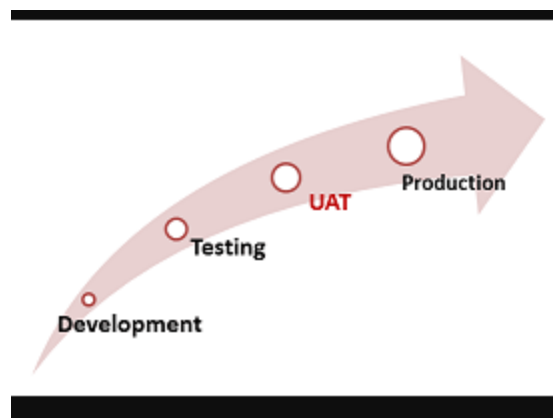
TESTCASEID	Tc_6
TESTCASELABEL	Training model.
TESTCASEEXPLANATION	Setting the train size and test size of the dataset.
INPUT GIVEN	User must select a larger percent of train dataset and smaller percent of test dataset.
EXPECTEDOUTPUT	The model will be successfully trained and tested.
ACTUAL OUTPUT	The model will not be saved successfully.
TESTCASESTATUS	Failure.



## 8.2 User Acceptance Testing

User Acceptance Testing (UAT) is a type of testing performed by the end user or the client to verify/accept the software system before moving the software application to the production environment. UAT is done in the final phase of testing after functional, integration and system testing is done.

Need of User Acceptance Testing arises once software has undergone Unit, Integration and System testing because developers might have built software based on requirements document by their own understanding and further required changes during development may not be effectively communicated to them, so for testing whether the final product is accepted by client/end-user, user acceptance testing is needed.



# 9. RESULTS

## 9.1 Performance Metrics

### Rainfall - Testing

The minimum temperature (-8.2 to 31.8) [degree celsius]

10

The maximum temperature (-4.8 to 47) [degree celsius]

19.7

Rainfall (0 to 278 ) [Millimeters]

11.6

The direction of the strongest gust during a particular day.

WNW

Speed of strongest gust during a particular day. (7 to 122) [kilometers per hour]

39

The humidity of the wind at 9 am. (%)

62

The humidity of the wind at 3 pm. (%)

41

Atmospheric pressure at 9 am. (977 to 1039)

1013

Atmospheric pressure at 3 pm. (982 to 1039)

1012

The temperature at 9 am. (-7.2 to 39.4) [degree Celsius]

12

The temperature at 3 pm. (-5.4 to 45.4) [degree Celsius]

18

Test

Temperature at 9 am. (-5.4 to 45.4) [degree Celsius]	<input type="text" value="18.7"/>
Rainfall (0 to 278) [Millimeters]	<input type="text" value="11.6"/>
The direction of the strongest gust during a particular day.	<input type="text" value="WNW"/>
Speed of strongest gust during a particular day. (7 to 122) [kilometers per hour]	<input type="text" value="39"/>
The humidity of the wind at 9 am. (%)	<input type="text" value="62"/>
The humidity of the wind at 3 pm. (%)	<input type="text" value="41"/>
Atmospheric pressure at 9 am. (977 to 1039)	<input type="text" value="1013"/>
Atmospheric pressure at 3 pm. (982 to 1039)	<input type="text" value="1012"/>
The temperature at 9 am. (-7.2 to 39.4) [degree Celsius]	<input type="text" value="12"/>
The temperature at 3 pm. (-5.4 to 45.4) [degree Celsius]	<input type="text" value="18"/>
<input type="button" value="Test"/>	

### Rainfall Prediction

Rain: Yes



## 10. ADVANTGES:

1. Forecasting gets you into the habit of looking at past and real-time data to predict future demand. And in doing so, you'll be able to anticipate demand fluctuations more effectively. But more than that, it'll give you insight into your company's health and provide you with an opportunity to course-correct or make adjustments.

2. You don't start from scratch after each forecast. Even if your prediction was nowhere close to what ended up coming to pass, it gives you a starting point. It's common to review where and why things didn't happen the way you predicted. Your forecasts should eventually improve. But more than that, you'll get into the habit of reflecting upon past performance as a whole. And self-reflection can be a powerful driver of company growth.

3. When done right, anticipating demand will help you tweak your processes to increase efficiency all along the supply chain. Because you're better able to predict what customers will want and when they'll want it, you may also be able to decrease excess inventory levels, thus increasing overall profitability.

## DISADVANTGES

1. Forecasts are never 100% accurate Let's face it: it's hard to predict the future. Even if you have a great process in place and forecasting experts on your payroll, your forecasts will never be spot on. Some products and markets simply have a high level of volatility. And in general, there is just an endless number of factors that influence demand.
- 2 Forecasting involves a lot of data gathering, data organizing, and coordination. Companies typically employ a team of demand planners who are responsible for coming up with the forecast. But in order to do this well, demand planners need substantial input from the sales and marketing teams. In addition, it's not uncommon for processes to be manual and labor-intensive, thus taking up a lot of time. Fortunately, if you have the right technology in place, this is much less of an issue.
3. On a related note, hiring a team of demand planners is a significant investment. When you add to that the cost of using good quality tools, upfront costs can add up. But investing in advanced software, high-quality talent and solid forecasting processes is just that: an investment. We're confident you'll see a return when all of that is done right.

## **Conclusion**

A detailed survey on rainfall predictions using KNN architecture over twenty-five years is done. From the survey it has been found that most of the researchers used different models for rainfall prediction but keras model of KNN gives significant results. KNN is the model with least mean squared error and accurate prediction. The survey also gives a conclusion that the forecasting techniques like Random forest, KNN & Xgboost are suitable to predict rainfall than other forecasting techniques such as statistical and numerical methods. However, some limitation of those methods has been found. The extensive references in support of the different developments of KNN research provided should be of great help to KNN & Random forest researchers to accurately predict rainfall in the future.

## **Future Scope**

In future this machine learning model may bind with various website which can provide real time data for weather or rainfall prediction. Weather forecasting is the prediction of the state of the atmosphere for a given location using the application of science and technology. This includes temperature, rain, cloudiness, wind speed, and humidity. Weather warnings are a special kind of short-range forecast carried out for the protection of human life. Irregular rainfall can have many impacts like destruction of crops and farms, damage of property so a better forecasting model is essential for an early warning that can minimize risks to life and property and also managing the agricultural farms in a better way.

## 13. APPENDIX

### INDEX PAGE:

```
<html>
<head>
  <meta charset="utf-8">
  <title>Rainfall Prediction</title>
  <meta content="width=device-width, initial-scale=1.0" name="viewport">
  <meta content="Free HTML Templates" name="keywords">
  <meta content="Free HTML Templates" name="description">

  <!-- Favicon -->
  <link href="img/favicon.ico" rel="icon">

  <!-- Google Web Fonts -->
  <link rel="preconnect" href="https://fonts.gstatic.com">
  <link
href="https://fonts.googleapis.com/css2?family=Poppins:wght@400;500;600;700&display=swap"
rel="stylesheet">

  <!-- Font Awesome -->
  <link href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.10.0/css/all.min.css"
rel="stylesheet">

  <!-- Libraries Stylesheet -->
  <link href="../static/lib/owlcarousel/assets/owl.carousel.min.css" rel="stylesheet">
  <link href="../static/lib/tempusdominus/css/tempusdominus-bootstrap-4.min.css"
rel="stylesheet" />

  <!-- Customized Bootstrap Stylesheet -->
  <link href="../static/css/style.css" rel="stylesheet">
</head>

<body>
  <!-- Topbar Start -->
  <div class="container-fluid bg-light pt-3 d-none d-lg-block">
    <div class="container">
      <div class="row">
        <div class="col-lg-6 text-center text-lg-left mb-2 mb-lg-0">
          <div class="d-inline-flex align-items-center">
            <p><i class="fa fa-envelope mr-2"></i>rainfall@info.com</p>
            <p class="text-body px-3">|</p>
            <p><i class="fa fa-phone-alt mr-2"></i>+012 345 6789</p>
          </div>
        </div>
      </div>
    </div>
  </div>
```

```

        <div class="col-lg-6 text-center text-lg-right">
            <div class="d-inline-flex align-items-center">
                <a class="text-primary px-3" href="">
                    <i class="fab fa-facebook-f"></i>
                </a>
                <a class="text-primary px-3" href="">
                    <i class="fab fa-twitter"></i>
                </a>
                <a class="text-primary px-3" href="">
                    <i class="fab fa-linkedin-in"></i>
                </a>
                <a class="text-primary px-3" href="">
                    <i class="fab fa-instagram"></i>
                </a>
                <a class="text-primary pl-3" href="">
                    <i class="fab fa-youtube"></i>
                </a>
            </div>
        </div>
    </div>
</div>
<!-- Topbar End -->

```

```

<!-- Navbar Start -->
<div class="container-fluid position-relative nav-bar p-0">
    <div class="container-lg position-relative p-0 px-lg-3" style="z-index: 9;">
        <nav class="navbar navbar-expand-lg bg-light navbar-light shadow-lg py-3 py-lg-0 pl-3 pl-lg-5">
            <a href="" class="navbar-brand">
                <h1 class="m-0 text-primary"><span class="text-dark">Rainfall</span>
                Prediction</h1>
            </a>
            <button type="button" class="navbar-toggler" data-toggle="collapse" data-target="#navbarCollapse">
                <span class="navbar-toggler-icon"></span>
            </button>
            <div class="collapse navbar-collapse justify-content-between px-3" id="navbarCollapse">
                <div class="navbar-nav ml-auto py-0">
                    <a href="/" class="nav-item nav-link active">Home</a>
                    <a href="/login" class="nav-item nav-link">Test</a>
                    <!--<a href="about.html" class="nav-item nav-link">About</a>
                    <a href="service.html" class="nav-item nav-link">Services</a>
                    <div class="nav-item dropdown">
                        <a href="#" class="nav-link dropdown-toggle" data-

```



```

toggle="dropdown">Pages</a>
        <div class="dropdown-menu border-0 rounded-0 m-0">
            <a href="blog.html" class="dropdown-item">Blog Grid</a>
            <a href="single.html" class="dropdown-item">Blog Detail</a>
            <a href="destination.html" class="dropdown-
item">Destination</a>
            <a href="guide.html" class="dropdown-item">Travel
Guides</a>
            <a href="testimonial.html" class="dropdown-
item">Testimonial</a>
        </div>
    </div>
    <a href="contact.html" class="nav-item nav-link">Contact</a>-->
</div>
</div>
</nav>
</div>
</div>
<!-- Navbar End -->

<!-- Carousel Start -->
<div class="container-fluid p-0">
    <div id="header-carousel" class="carousel slide" data-ride="carousel">
        <div class="carousel-inner">
            <div class="carousel-item active">
                
                <div class="carousel-caption d-flex flex-column align-items-center
justify-content-center">
                    <div class="p-3" style="max-width: 900px;">
                        <h4 class="text-white text-uppercase mb-md-3"></h4>
                        <h1 class="display-3 text-white mb-md-4">Rainfall
Prediction</h1>
                        <a href="" class="btn btn-primary py-md-3 px-md-5 mt-2">Read
More</a>
                    </div>
                </div>
            </div>
            <div class="carousel-item">
                
                <div class="carousel-caption d-flex flex-column align-items-center
justify-content-center">
                    <div class="p-3" style="max-width: 900px;">
                        <h4 class="text-white text-uppercase mb-md-3"></h4>
                        <h1 class="display-3 text-white mb-md-4">Rainfall
Prediction</h1>
                        <a href="" class="btn btn-primary py-md-3 px-md-5 mt-2">Read

```

More</a>

</div>

</div>

</div>

</div>

<a class="carousel-control-prev" href="#header-carousel" data-slide="prev">

<div class="btn btn-dark" style="width: 45px; height: 45px;">

<span class="carousel-control-prev-icon mb-n2"></span>

</div>

</a>

<a class="carousel-control-next" href="#header-carousel" data-slide="next">

<div class="btn btn-dark" style="width: 45px; height: 45px;">

<span class="carousel-control-next-icon mb-n2"></span>

</div>

</a>

</div>

</div>

<!-- Carousel End -->

<!-- Booking Start -->

<div class="container-fluid booking mt-5 pb-5">

<div class="container pb-5">

<div class="bg-light shadow" style="padding: 30px;">

<div class="row align-items-center" style="min-height: 60px;">

<div class="col-md-10">

<form name="form1" method="post">

<div class="row">

<div class="col-md-3">

<div class="mb-3 mb-md-0">

<h5>Admin Login</h5>

</div>

</div>

<div class="col-md-3">

<div class="mb-3 mb-md-0">

<div class="date" id="date1" data-target-

input="nearest">

<input type="text" name="uname" class="form-control

p-4 datetimepicker-input" placeholder="Username" required />

</div>

</div>

</div>

<div class="col-md-3">

<div class="mb-3 mb-md-0">

<div class="date" id="date2" data-target-

input="nearest">

```

        <input type="password" name="pass" class="form-
control p-4 datetimepicker-input" placeholder="Password" required />
    </div>
</div>
<div class="col-md-3">
    <button class="btn btn-primary btn-block" type="submit"
name="btn" style="height: 47px; margin-top: -2px;">Login</button>
</div>

</div>
</form>
<span style="color:#FF0000">{{msg}}</span>
</div>

</div>
</div>
</div>
<!-- Booking End -->

<!-- About Start -->
<div class="container-fluid py-5">
    <div class="container pt-5">
        <div class="row">
            <div class="col-lg-6" style="min-height: 500px;">
                <div class="position-relative h-100">
                    
                </div>
            </div>
            <div class="col-lg-6 pt-5 pb-lg-5">
                <div class="about-text bg-white p-4 p-lg-5 my-lg-5">
                    <h6 class="text-primary text-uppercase" style="letter-spacing:
5px;">About Us</h6>

                    <h1 class="mb-3">Rainfall Prediction</h1>
                    <p>Rainfall is a measurement of how much water falls as rain in a
certain period of time. Rainfall is measured by collecting rain water across different areas
and times.</p>

                    <div class="row mb-4">
                        <div class="col-6">
                            
                        </div>
                        <!--<div class="col-6">
                            
                        </div-->

```

```

        </div>
        <a href="" class="btn btn-primary mt-1">Read</a>
    </div>
</div>
</div>
</div>
</div>
<!-- About End -->

<!-- Feature Start -->
<div class="container-fluid pb-5">
    <div class="container pb-5">
        <div class="row">
            <div class="col-md-4">
                <div class="d-flex mb-4 mb-lg-0">
                    <div class="d-flex flex-shrink-0 align-items-center justify-content-center bg-primary mr-3" style="height: 100px; width: 100px;">
                        <i class="fa fa-2x fa-money-check-alt text-white"></i>
                    </div>
                    <div class="d-flex flex-column">
                        <h5 class="">Rainfall</h5>
                        <p class="m-0">Magna sit magna dolor duo dolor labore rebum amet elittr est diam sea</p>
                    </div>
                </div>
            </div>
            <div class="col-md-4">
                <div class="d-flex mb-4 mb-lg-0">
                    <div class="d-flex flex-shrink-0 align-items-center justify-content-center bg-primary mr-3" style="height: 100px; width: 100px;">
                        <i class="fa fa-2x fa-award text-white"></i>
                    </div>
                    <div class="d-flex flex-column">
                        <h5 class="">Cyclone</h5>
                        <p class="m-0">Magna sit magna dolor duo dolor labore rebum amet elittr est diam sea</p>
                    </div>
                </div>
            </div>
            <div class="col-md-4">
                <div class="d-flex mb-4 mb-lg-0">
                    <div class="d-flex flex-shrink-0 align-items-center justify-content-center bg-primary mr-3" style="height: 100px; width: 100px;">
                        <i class="fa fa-2x fa-globe text-white"></i>
                    </div>
                    <div class="d-flex flex-column">

```

```

        <h5 class="">Weather Report</h5>
        <p class="m-0">Magna sit magna dolor duo dolor labore rebum
amet elit<tr><td>est diam sea</p>
        </div>
    </div>
</div>
</div>
</div>
</div>
</div>
<!-- Feature End -->

<!-- Destination Start -->

<!-- Destination Start -->

<!-- Service Start -->

<!-- Service End -->

<!-- Packages Start -->

<!-- Packages End -->

<!-- Registration Start -->

<!-- Registration End -->

<!-- Team Start -->

<!-- Team End -->

<!-- Testimonial Start -->

<!-- Testimonial End -->

<!-- Blog Start -->

<!-- Blog End -->

```

```

<!-- Footer Start -->
<div class="container-fluid bg-dark text-white-50 py-5 px-sm-3 px-lg-5" style="margin-top: 90px;">
    <div class="row pt-5">
        <div class="col-lg-3 col-md-6 mb-5">
            <a href="#" class="navbar-brand">
                <h1 class="text-primary"><span class="text-white">Rainfall</span></h1>
            </a>
            <p>Rainfall is a measurement of how much water falls as rain in a certain period of time. Rainfall is measured by collecting rain water across different areas and times.</p>
            <h6 class="text-white text-uppercase mt-4 mb-3" style="letter-spacing: 5px;">Follow Us</h6>
            <div class="d-flex justify-content-start">
                <a class="btn btn-outline-primary btn-square mr-2" href="#"><i class="fab fa-twitter"></i></a>
                <a class="btn btn-outline-primary btn-square mr-2" href="#"><i class="fab fa-facebook-f"></i></a>
                <a class="btn btn-outline-primary btn-square mr-2" href="#"><i class="fab fa-linkedin-in"></i></a>
                <a class="btn btn-outline-primary btn-square" href="#"><i class="fab fa-instagram"></i></a>
            </div>
        </div>
        <div class="col-lg-3 col-md-6 mb-5">
            <h5 class="text-white text-uppercase mb-4" style="letter-spacing: 5px;">Our Services</h5>
            <div class="d-flex flex-column justify-content-start">
                <a class="text-white-50 mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>About</a>
                <a class="text-white-50 mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Services</a>
                <a class="text-white-50" href="#"><i class="fa fa-angle-right mr-2"></i>Blog</a>
            </div>
        </div>
        <div class="col-lg-3 col-md-6 mb-5">
            <h5 class="text-white text-uppercase mb-4" style="letter-spacing: 5px;">Contact Us</h5>
            <p><i class="fa fa-map-marker-alt mr-2"></i>Tamilnadu</p>
            <p><i class="fa fa-phone-alt mr-2"></i>+012 345 67890</p>
            <p><i class="fa fa-envelope mr-2"></i>rainfall@info.com</p>
        </div>
    </div>
</div>
</div>

```

```

<div class="container-fluid bg-dark text-white border-top py-4 px-sm-3 px-md-5"
style="border-color: rgba(256, 256, 256, .1) !important;">
    <div class="row">
        <div class="col-lg-6 text-center text-md-left mb-3 mb-md-0">
            <p class="m-0 text-white-50">Rainfall Prediction <a href="#"></a></a>
            </p>
        </div>
        <div class="col-lg-6 text-center text-md-right">
            <p class="m-0 text-white-50"><a href="https://htmlcodex.com"></a>
            </p>
        </div>
    </div>
</div>
<!-- Footer End -->

<!-- Back to Top -->
<a href="#" class="btn btn-lg btn-primary btn-lg-square back-to-top"><i class="fa fa-
angle-double-up"></i></a>

<!-- JavaScript Libraries -->
<script src="https://code.jquery.com/jquery-3.4.1.min.js"></script>
<script
src="https://stackpath.bootstrapcdn.com/bootstrap/4.4.1/js/bootstrap.bundle.min.js"></scrip
t>
<script src="../../static/lib/easing/easing.min.js"></script>
<script src="../../static/lib/owlcarousel/owl.carousel.min.js"></script>
<script src="../../static/lib/tempusdominus/js/moment.min.js"></script>
<script src="../../static/lib/tempusdominus/js/moment-timezone.min.js"></script>
<script src="../../static/lib/tempusdominus/js/tempusdominus-bootstrap-4.min.js"></script>

<!-- Contact Javascript File -->
<script src="../../static/mail/jqBootstrapValidation.min.js"></script>
<script src="../../static/mail/contact.js"></script>

<!-- Template Javascript -->
<script src="../../static/js/main.js"></script>
</body>

</html>

```

## REGISTER PAGE:

```

<html>
<head>
    <meta charset="utf-8">

```

```
<title>Rainfall Prediction</title>
<meta content="width=device-width, initial-scale=1.0" name="viewport">
<meta content="Free HTML Templates" name="keywords">
<meta content="Free HTML Templates" name="description">

<!-- Favicon -->
<link href="../../static/img/favicon.ico" rel="icon">

<!-- Google Web Fonts -->
<link rel="preconnect" href="https://fonts.gstatic.com">
<link
href="https://fonts.googleapis.com/css2?family=Poppins:wght@400;500;600;700&display=swap"
rel="stylesheet">

<!-- Font Awesome -->
<link href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.10.0/css/all.min.css"
rel="stylesheet">

<!-- Libraries Stylesheet -->
<link href="../../static/lib/owlcarousel/assets/owl.carousel.min.css" rel="stylesheet">
<link href="../../static/lib/tempusdominus/css/tempusdominus-bootstrap-4.min.css"
rel="stylesheet" />

<!-- Customized Bootstrap Stylesheet -->
<link href="../../static/css/style.css" rel="stylesheet">
</head>

<body>
<!-- Topbar Start -->
<div class="container-fluid bg-light pt-3 d-none d-lg-block">
  <div class="container">
    <div class="row">
      <div class="col-lg-6 text-center text-lg-left mb-2 mb-lg-0">
        <div class="d-inline-flex align-items-center">
          <p><i class="fa fa-envelope mr-2"></i>rainfall@info.com</p>
          <p class="text-body px-3">|</p>
          <p><i class="fa fa-phone-alt mr-2"></i>+012 345 6789</p>
        </div>
      </div>
      <div class="col-lg-6 text-center text-lg-right">
        <div class="d-inline-flex align-items-center">
          <a class="text-primary px-3" href="">
            <i class="fab fa-facebook-f"></i>
          </a>
          <a class="text-primary px-3" href="">
            <i class="fab fa-twitter"></i>
          </a>
        </div>
      </div>
    </div>
  </div>
</div>
```



```

        <a class="text-primary px-3" href="">
            <i class="fab fa-linkedin-in"></i>
        </a>
        <a class="text-primary px-3" href="">
            <i class="fab fa-instagram"></i>
        </a>
        <a class="text-primary pl-3" href="">
            <i class="fab fa-youtube"></i>
        </a>
    </div>
</div>
</div>
</div>
</div>
<!-- Topbar End -->

<!-- Navbar Start -->
<div class="container-fluid position-relative nav-bar p-0">
    <div class="container-lg position-relative p-0 px-lg-3" style="z-index: 9;">
        <nav class="navbar navbar-expand-lg bg-light navbar-light shadow-lg py-3 py-lg-0 pl-3 pl-lg-5">
            <a href="" class="navbar-brand">
                <h1 class="m-0 text-primary"><span class="text-dark">Rainfall</span>
Prediction</h1>
            </a>
            <button type="button" class="navbar-toggler" data-toggle="collapse" data-target="#navbarCollapse">
                <span class="navbar-toggler-icon"></span>
            </button>
            <div class="collapse navbar-collapse justify-content-between px-3" id="navbarCollapse">
                <div class="navbar-nav ml-auto py-0">
                    <a href="/test_data" class="nav-item nav-link active">Home</a>
                    <a href="/logout" class="nav-item nav-link">Logout</a>
                </div>
            </div>
        </nav>
    </div>
</div>
<!-- Navbar End -->

<!-- Header Start -->
<div class="container-fluid page-header">
    <div class="container">

```

```

        <div class="d-flex flex-column align-items-center justify-content-center"
style="min-height: 400px">
            <h3 class="display-4 text-white text-uppercase"></h3>
            <div class="d-inline-flex text-white">
                <p class="m-0 text-uppercase"><a class="text-white"
href="">Rainfall</a></p>
                <i class="fa fa-angle-double-right pt-1 px-3"></i>

            </div>
        </div>
    </div>
</div>
<!-- Header End -->

<!-- Booking Start -->
<div class="container-fluid booking mt-5 pb-5">
    <div class="container pb-5">
        <div class="bg-light shadow" style="padding: 30px;">
            <div class="row align-items-center" style="min-height: 60px;">
                <div class="col-md-10">
                    <h3 align="center">User: {{name}} - Testing</h3>
                    <form name="form1" method="post" action="">
                        <div class="row">
                            <div class="col-md-6">
                                The minimum temperature (-8.2 to 31.8) [degree
celsius]

                                </div>
                                <div class="col-md-4">
                                    <input type="text" name="min_temp" class="form-control"
placeholder="" value="{{min_temp}}" required>
                                </div>

                            </div>
                            <br>
                            <div class="row">
                                <div class="col-md-6">
                                    The maximum temperature (-4.8 to 47) [degree
celsius]

                                </div>
                                <div class="col-md-4">
                                    <input type="text" name="max_temp" class="form-control"
placeholder="" value="{{max_temp}}" required>
                                </div>

                            </div>
                            <br>

```

```

        <div class="row">
            <div class="col-md-6">
                Rainfall (0 to 278 ) [Millimeters]
            </div>
            <div class="col-md-4">
                <input type="text" name="rain" class="form-control"
placeholder="" value="{{rain}}" required>
            </div>

        </div>
        <br>
        <div class="row">
            <div class="col-md-6">
                The direction of the strongest gust during a
particular day.

            </div>
            <div class="col-md-4">
                <select name="gust_dir" class="form-control">
                    <option>S</option>
                    <option>ENE</option>
                    <option>ESE</option>
                    <option>N</option>
                    <option>NA</option>
                    <option>NE</option>
                    <option>NNE</option>
                    <option>NNW</option>
                    <option>NW</option>
                    <option>S</option>
                    <option>SE</option>
                    <option>SSE</option>
                    <option>SSW</option>
                    <option>SW</option>
                    <option>W</option>
                    <option>WNW</option>
                    <option>WSW</option>
                </select>
            </div>

        </div>
        <br>
        <div class="row">
            <div class="col-md-6">
                Speed of strongest gust during a particular day. (7
to 122) [kilometers per hour]

            </div>
            <div class="col-md-4">
                <input type="text" name="gust_speed" class="form-control"

```

```

placeholder="" value="{{gust_speed}}" required>
    </div>

    </div>
    <br>
    <div class="row">
        <div class="col-md-6">
            The humidity of the wind at 9 am. (%)
        </div>
        <div class="col-md-4">
            <input type="text" name="hum1" class="form-control"
placeholder="" value="{{hum1}}" required>
        </div>

    </div>
    <br>
    <div class="row">
        <div class="col-md-6">
            The humidity of the wind at 3 pm. (%)
        </div>
        <div class="col-md-4">
            <input type="text" name="hum2" class="form-control"
placeholder="" value="{{hum2}}" required>
        </div>

    </div>
    <br>
    <div class="row">
        <div class="col-md-6">
            Atmospheric pressure at 9 am. (977 to 1039)
        </div>
        <div class="col-md-4">
            <input type="text" name="pres1" class="form-control"
placeholder="" value="{{pres1}}" required>
        </div>

    </div>
    <br>
    <div class="row">
        <div class="col-md-6">
            Atmospheric pressure at 3 pm. (982 to 1039)
        </div>
        <div class="col-md-4">
            <input type="text" name="pres2" class="form-control"
placeholder="" value="{{pres2}}" required>
        </div>

```

```

        </div>
        <br>

        <div class="row">
            <div class="col-md-6">
                The temperature at 9 am. (-7.2 to 39.4) [degree
Celsius]

            </div>
            <div class="col-md-4">
                <input type="text" name="temp1" class="form-control"
placeholder="" value="{{temp1}}" required>
            </div>

        </div>
        <br>
        <div class="row">
            <div class="col-md-6">
                The temperature at 3 pm. (-5.4 to 45.4) [degree
Celsius]

            </div>
            <div class="col-md-4">
                <input type="text" name="temp2" class="form-control"
placeholder="" value="{{temp2}}" required>
            </div>

        </div>
        <br>
        <div class="row">

            <div class="col-md-6">

            </div>
            <div class="col-md-4">
                <button class="btn btn-primary btn-block" type="submit"
style="height: 47px; margin-top: -2px;">Test</button>
            </div>

        </div>
        </form>
        {% if act=="1" %}
        <h4 align="center">Rainfall Prediction</h4>
        {% if res=="Yes" %}
        <h5 align="center" style="color:#009900">Rain: Yes</h5>
        {% else %}
        <h5 align="center" style="color:#FF6600">Rain: No</h5>
        {% endif %}

```

```

                                {% endif %}

                                </div>

                                </div>
                                </div>
                                </div>
                                </div>
                                <!-- Booking End -->

                                <!-- About Start -->

                                <!-- About End -->

                                <!-- Feature Start -->

                                <!-- Feature End -->

                                <!-- Registration Start -->

                                <!-- Registration End -->

                                <!-- Team Start -->

                                <!-- Team End -->

                                <!-- Footer Start -->
                                <div class="container-fluid bg-dark text-white-50 py-5 px-sm-3 px-lg-5" style="margin-top: 90px;">
                                    <div class="row pt-5">
                                        <div class="col-lg-3 col-md-6 mb-5">
                                            <a href="" class="navbar-brand">
                                                <h1 class="text-primary"><span class="text-white">Rainfall</span></h1>
                                            </a>
                                            <p>Rainfall is a measurement of how much water falls as rain in a certain period of time. Rainfall is measured by collecting rain water across different areas and times.</p>
                                            <h6 class="text-white text-uppercase mt-4 mb-3" style="letter-spacing: 5px;">Follow Us</h6>
                                            <div class="d-flex justify-content-start">
                                                <a class="btn btn-outline-primary btn-square mr-2" href="#"><i class="fab fa-twitter"></i></a>

```

```

                <a class="btn btn-outline-primary btn-square mr-2" href="#"><i
class="fab fa-facebook-f"></i></a>
                <a class="btn btn-outline-primary btn-square mr-2" href="#"><i
class="fab fa-linkedin-in"></i></a>
                <a class="btn btn-outline-primary btn-square" href="#"><i class="fab
fa-instagram"></i></a>
            </div>
        </div>
        <div class="col-lg-3 col-md-6 mb-5">
            <h5 class="text-white text-uppercase mb-4" style="letter-spacing: 5px;">Our
Services</h5>
            <div class="d-flex flex-column justify-content-start">
                <a class="text-white-50 mb-2" href="#"><i class="fa fa-angle-right mr-
2"></i>About</a>
                <a class="text-white-50 mb-2" href="#"><i class="fa fa-angle-right mr-
2"></i>Services</a>
                <a class="text-white-50" href="#"><i class="fa fa-angle-right mr-
2"></i>Blog</a>
            </div>
        </div>

        <div class="col-lg-3 col-md-6 mb-5">
            <h5 class="text-white text-uppercase mb-4" style="letter-spacing:
5px;">Contact Us</h5>
            <p><i class="fa fa-map-marker-alt mr-2"></i>Tamilnadu</p>
            <p><i class="fa fa-phone-alt mr-2"></i>+012 345 67890</p>
            <p><i class="fa fa-envelope mr-2"></i>rainfall@info.com</p>

        </div>
    </div>
</div>
<div class="container-fluid bg-dark text-white border-top py-4 px-sm-3 px-md-5"
style="border-color: rgba(256, 256, 256, .1) !important;">
    <div class="row">
        <div class="col-lg-6 text-center text-md-left mb-3 mb-md-0">
            <p class="m-0 text-white-50">Rainfall Prediction <a href="#"></a></a>
            </p>
        </div>
        <div class="col-lg-6 text-center text-md-right">
            <p class="m-0 text-white-50"> <a href="https://htmlcodex.com"></a>
            </p>
        </div>
    </div>
</div>
<!-- Footer End -->

```

```

<!-- Back to Top -->
<a href="#" class="btn btn-lg btn-primary btn-lg-square back-to-top"><i class="fa fa-angle-double-up"></i></a>

<!-- JavaScript Libraries -->
<script src="https://code.jquery.com/jquery-3.4.1.min.js"></script>
<script
src="https://stackpath.bootstrapcdn.com/bootstrap/4.4.1/js/bootstrap.bundle.min.js"></scrip
t>
<script src="../../static/lib/easing/easing.min.js"></script>
<script src="../../static/lib/owlcarousel/owl.carousel.min.js"></script>
<script src="../../static/lib/tempusdominus/js/moment.min.js"></script>
<script src="../../static/lib/tempusdominus/js/moment-timezone.min.js"></script>
<script src="../../static/lib/tempusdominus/js/tempusdominus-bootstrap-4.min.js"></script>

<!-- Contact Javascript File -->
<script src="../../static/mail/jqBootstrapValidation.min.js"></script>
<script src="../../static/mail/contact.js"></script>

<!-- Template Javascript -->
<script src="../../static/js/main.js"></script>
</body>

</html>

```

## LOGIN PAGE:

```

<html>
<head>
<meta charset="utf-8">
<title>Rainfall Prediction</title>
<meta content="width=device-width, initial-scale=1.0" name="viewport">
<meta content="Free HTML Templates" name="keywords">
<meta content="Free HTML Templates" name="description">

<!-- Favicon -->
<link href="img/favicon.ico" rel="icon">

```



```
<!-- Google Web Fonts -->
<link rel="preconnect" href="https://fonts.gstatic.com">
<link
href="https://fonts.googleapis.com/css2?family=Poppins:wght@400;500;600;700&display=swap"
rel="stylesheet">

<!-- Font Awesome -->
<link href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.10.0/css/all.min.css"
rel="stylesheet">

<!-- Libraries Stylesheet -->
<link href="../../static/lib/owlcarousel/assets/owl.carousel.min.css" rel="stylesheet">
<link href="../../static/lib/tempusdominus/css/tempusdominus-bootstrap-4.min.css"
rel="stylesheet" />

<!-- Customized Bootstrap Stylesheet -->
<link href="../../static/css/style.css" rel="stylesheet">
</head>

<body>
<!-- Topbar Start -->
<div class="container-fluid bg-light pt-3 d-none d-lg-block">
  <div class="container">
    <div class="row">
      <div class="col-lg-6 text-center text-lg-left mb-2 mb-lg-0">
        <div class="d-inline-flex align-items-center">
          <p><i class="fa fa-envelope mr-2"></i>rainfall@info.com</p>
          <p class="text-body px-3">|</p>
          <p><i class="fa fa-phone-alt mr-2"></i>+012 345 6789</p>
        </div>
      </div>
      <div class="col-lg-6 text-center text-lg-right">
        <div class="d-inline-flex align-items-center">
          <a class="text-primary px-3" href="">
            <i class="fab fa-facebook-f"></i>
          </a>
          <a class="text-primary px-3" href="">
            <i class="fab fa-twitter"></i>
          </a>
          <a class="text-primary px-3" href="">
            <i class="fab fa-linkedin-in"></i>
          </a>
          <a class="text-primary px-3" href="">
            <i class="fab fa-instagram"></i>
          </a>
          <a class="text-primary pl-3" href="">

```

```

        <i class="fab fa-youtube"></i>
      </a>
    </div>
  </div>
</div>
</div>
</div>
</div>
<!-- Topbar End -->

<!-- Navbar Start -->
<div class="container-fluid position-relative nav-bar p-0">
  <div class="container-lg position-relative p-0 px-lg-3" style="z-index: 9;">
    <nav class="navbar navbar-expand-lg bg-light navbar-light shadow-lg py-3 py-lg-
0 pl-3 pl-lg-5">
      <a href="" class="navbar-brand">
        <h1 class="m-0 text-primary"><span class="text-dark">Rainfall</span>
Prediction</h1>
      </a>
      <button type="button" class="navbar-toggler" data-toggle="collapse" data-
target="#navbarCollapse">
        <span class="navbar-toggler-icon"></span>
      </button>
      <div class="collapse navbar-collapse justify-content-between px-3"
id="navbarCollapse">
        <div class="navbar-nav ml-auto py-0">
          <a href="/" class="nav-item nav-link active">Home</a>
          <a href="/test_data" class="nav-item nav-link">Test</a>
          <!--<a href="about.html" class="nav-item nav-link">About</a>
          <a href="service.html" class="nav-item nav-link">Services</a>
          <div class="nav-item dropdown">
            <a href="#" class="nav-link dropdown-toggle" data-
toggle="dropdown">Pages</a>
            <div class="dropdown-menu border-0 rounded-0 m-0">
              <a href="blog.html" class="dropdown-item">Blog Grid</a>
              <a href="single.html" class="dropdown-item">Blog Detail</a>
              <a href="destination.html" class="dropdown-
item">Destination</a>
              <a href="guide.html" class="dropdown-item">Travel
Guides</a>
              <a href="testimonial.html" class="dropdown-
item">Testimonial</a>
            </div>
          </div>
          <a href="contact.html" class="nav-item nav-link">Contact</a>-->
        </div>
      </div>
    </div>
  </div>

```

```

        </nav>
    </div>
</div>
<!-- Navbar End -->

<!-- Carousel Start -->
<div class="container-fluid p-0">
    <div id="header-carousel" class="carousel slide" data-ride="carousel">
        <div class="carousel-inner">
            <div class="carousel-item active">
                
                <div class="carousel-caption d-flex flex-column align-items-center justify-content-center">
                    <div class="p-3" style="max-width: 900px;">
                        <h4 class="text-white text-uppercase mb-md-3"></h4>
                        <h1 class="display-3 text-white mb-md-4">Rainfall
Prediction</h1>
                        <a href="" class="btn btn-primary py-md-3 px-md-5 mt-2">Read
More</a>
                    </div>
                </div>
            </div>
            <div class="carousel-item">
                
                <div class="carousel-caption d-flex flex-column align-items-center justify-content-center">
                    <div class="p-3" style="max-width: 900px;">
                        <h4 class="text-white text-uppercase mb-md-3"></h4>
                        <h1 class="display-3 text-white mb-md-4">Rainfall
Prediction</h1>
                        <a href="" class="btn btn-primary py-md-3 px-md-5 mt-2">Read
More</a>
                    </div>
                </div>
            </div>
        </div>
        <a class="carousel-control-prev" href="#header-carousel" data-slide="prev">
            <div class="btn btn-dark" style="width: 45px; height: 45px;">
                <span class="carousel-control-prev-icon mb-n2"></span>
            </div>
        </a>
        <a class="carousel-control-next" href="#header-carousel" data-slide="next">
            <div class="btn btn-dark" style="width: 45px; height: 45px;">
                <span class="carousel-control-next-icon mb-n2"></span>
            </div>
        </a>
    </div>

```

```

        </div>
</div>
<!-- Carousel End -->

<!-- Booking Start -->
<div class="container-fluid booking mt-5 pb-5">
    <div class="container pb-5">
        <div class="bg-light shadow" style="padding: 30px;">
            <div class="row align-items-center" style="min-height: 60px;">
                <div class="col-md-10">
                    <form name="form1" method="post">
                        <div class="row">

                            <div class="col-md-3">
                                <div class="mb-3 mb-md-0">
                                    <h5>User Login</h5>
                                </div>
                            </div>
                            <div class="col-md-3">
                                <div class="mb-3 mb-md-0">
                                    <div class="date" id="date1" data-target-
input="nearest">
                                        <input type="text" name="uname" class="form-control
p-4 datetimepicker-input" placeholder="Username" required />
                                    </div>
                                </div>
                            </div>

                            <div class="col-md-3">
                                <div class="mb-3 mb-md-0">
                                    <div class="date" id="date2" data-target-
input="nearest">
                                        <input type="password" name="pass" class="form-
control p-4 datetimepicker-input" placeholder="Password" required />
                                    </div>
                                </div>
                            </div>

                            <div class="col-md-3">
                                <button class="btn btn-primary btn-block" type="submit"
name="btn" style="height: 47px; margin-top: -2px;">Login</button>
                            </div>

                        </div>
                    </form>
                    <span style="color:#FF0000">{{msg}}</span>
                </div>
            </div>
        </div>
    </div>
</div>

```

```

        <br>
        <a href="/register">New User</a>
    </div>

</div>
</div>
</div>
</div>
<!-- Booking End -->

<!-- About Start -->
<div class="container-fluid py-5">
    <div class="container pt-5">
        <div class="row">
            <div class="col-lg-6" style="min-height: 500px;">
                <div class="position-relative h-100">
                    
                </div>
            </div>
            <div class="col-lg-6 pt-5 pb-lg-5">
                <div class="about-text bg-white p-4 p-lg-5 my-lg-5">
                    <h6 class="text-primary text-uppercase" style="letter-spacing:
5px;">About Us</h6>

                    <h1 class="mb-3">Rainfall Prediction</h1>
                    <p>Rainfall is a measurement of how much water falls as rain in a
certain period of time. Rainfall is measured by collecting rain water across different areas
and times.</p>

                    <div class="row mb-4">
                        <div class="col-6">
                            
                        </div>
                        <!--<div class="col-6">
                            
                        </div-->
                    </div>
                    <a href="" class="btn btn-primary mt-1">Read</a>
                </div>
            </div>
        </div>
    </div>
</div>
<!-- About End -->

<!-- Feature Start -->

```

```

<div class="container-fluid pb-5">
  <div class="container pb-5">
    <div class="row">
      <div class="col-md-4">
        <div class="d-flex mb-4 mb-lg-0">
          <div class="d-flex flex-shrink-0 align-items-center justify-content-center bg-primary mr-3" style="height: 100px; width: 100px;">
            <i class="fa fa-2x fa-money-check-alt text-white"></i>
          </div>
          <div class="d-flex flex-column">
            <h5 class="">Rainfall</h5>
            <p class="m-0">Magna sit magna dolor duo dolor labore rebum amet elittr est diam sea</p>
          </div>
        </div>
      </div>
      <div class="col-md-4">
        <div class="d-flex mb-4 mb-lg-0">
          <div class="d-flex flex-shrink-0 align-items-center justify-content-center bg-primary mr-3" style="height: 100px; width: 100px;">
            <i class="fa fa-2x fa-award text-white"></i>
          </div>
          <div class="d-flex flex-column">
            <h5 class="">Cyclone</h5>
            <p class="m-0">Magna sit magna dolor duo dolor labore rebum amet elittr est diam sea</p>
          </div>
        </div>
      </div>
      <div class="col-md-4">
        <div class="d-flex mb-4 mb-lg-0">
          <div class="d-flex flex-shrink-0 align-items-center justify-content-center bg-primary mr-3" style="height: 100px; width: 100px;">
            <i class="fa fa-2x fa-globe text-white"></i>
          </div>
          <div class="d-flex flex-column">
            <h5 class="">Weather Report</h5>
            <p class="m-0">Magna sit magna dolor duo dolor labore rebum amet elittr est diam sea</p>
          </div>
        </div>
      </div>
    </div>
  </div>
</div>
<!-- Feature End -->

```

<!-- Destination Start -->

<!-- Destination Start -->

<!-- Service Start -->

<!-- Service End -->

<!-- Packages Start -->

<!-- Packages End -->

<!-- Registration Start -->

<!-- Registration End -->

<!-- Team Start -->

<!-- Team End -->

<!-- Testimonial Start -->

<!-- Testimonial End -->

<!-- Blog Start -->

<!-- Blog End -->

<!-- Footer Start -->

```
<div class="container-fluid bg-dark text-white-50 py-5 px-sm-3 px-lg-5" style="margin-top: 90px;">
  <div class="row pt-5">
    <div class="col-lg-3 col-md-6 mb-5">
      <a href="" class="navbar-brand">
        <h1 class="text-primary"><span class="text-white">Rainfall</span></h1>
      </a>
      <p>Rainfall is a measurement of how much water falls as rain in a certain period of time. Rainfall is measured by collecting rain water across different areas and times.</p>
```

```

        <h6 class="text-white text-uppercase mt-4 mb-3" style="letter-spacing:
5px;">Follow Us</h6>
        <div class="d-flex justify-content-start">
            <a class="btn btn-outline-primary btn-square mr-2" href="#"><i
class="fab fa-twitter"></i></a>
            <a class="btn btn-outline-primary btn-square mr-2" href="#"><i
class="fab fa-facebook-f"></i></a>
            <a class="btn btn-outline-primary btn-square mr-2" href="#"><i
class="fab fa-linkedin-in"></i></a>
            <a class="btn btn-outline-primary btn-square" href="#"><i class="fab
fa-instagram"></i></a>
        </div>
    </div>
    <div class="col-lg-3 col-md-6 mb-5">
        <h5 class="text-white text-uppercase mb-4" style="letter-spacing: 5px;">Our
Services</h5>
        <div class="d-flex flex-column justify-content-start">
            <a class="text-white-50 mb-2" href="#"><i class="fa fa-angle-right mr-
2"></i>About</a>
            <a class="text-white-50 mb-2" href="#"><i class="fa fa-angle-right mr-
2"></i>Services</a>
            <a class="text-white-50" href="#"><i class="fa fa-angle-right mr-
2"></i>Blog</a>
        </div>
    </div>

    <div class="col-lg-3 col-md-6 mb-5">
        <h5 class="text-white text-uppercase mb-4" style="letter-spacing:
5px;">Contact Us</h5>
        <p><i class="fa fa-map-marker-alt mr-2"></i>Tamilnadu</p>
        <p><i class="fa fa-phone-alt mr-2"></i>+012 345 67890</p>
        <p><i class="fa fa-envelope mr-2"></i>rainfall@info.com</p>

    </div>
</div>
</div>
<div class="container-fluid bg-dark text-white border-top py-4 px-sm-3 px-md-5"
style="border-color: rgba(256, 256, 256, .1) !important;">
    <div class="row">
        <div class="col-lg-6 text-center text-md-left mb-3 mb-md-0">
            <p class="m-0 text-white-50">Rainfall Prediction <a href="#"></a></a>
            </p>
        </div>
        <div class="col-lg-6 text-center text-md-right">
            <p class="m-0 text-white-50"><a href="https://htmlcodex.com"></a>
            </p>
        </div>
    </div>

```



```

        </div>
</div>
<!-- Footer End -->

<!-- Back to Top -->
<a href="#" class="btn btn-lg btn-primary btn-lg-square back-to-top"><i class="fa fa-angle-double-up"></i></a>

<!-- JavaScript Libraries -->
<script src="https://code.jquery.com/jquery-3.4.1.min.js"></script>
<script
src="https://stackpath.bootstrapcdn.com/bootstrap/4.4.1/js/bootstrap.bundle.min.js"></scrip
t>
<script src="../../static/lib/easing/easing.min.js"></script>
<script src="../../static/lib/owlcarousel/owl.carousel.min.js"></script>
<script src="../../static/lib/tempusdominus/js/moment.min.js"></script>
<script src="../../static/lib/tempusdominus/js/moment-timezone.min.js"></script>
<script src="../../static/lib/tempusdominus/js/tempusdominus-bootstrap-4.min.js"></script>

<!-- Contact Javascript File -->
<script src="../../static/mail/jqBootstrapValidation.min.js"></script>
<script src="../../static/mail/contact.js"></script>

<!-- Template Javascript -->
<script src="../../static/js/main.js"></script>
</body>

</html>

```

## Machine Learning:

```

knn_model = KNeighborsClassifier()
knn_model.fit(X_train, y_train)
knn_model.predict(X_val)
knn_model_score = knn_model.score(X_val, y_val)
knn_model_accuracy = round(knn_model_score*100, 2)
print(&quot;The classification accuracy of KNN model is &quot;+
str(knn_model_accuracy)+&quot;%&quot;.)
y_pred = knn_model.predict(X_val)
cm = confusion_matrix(y_val, y_pred)
axes = sns.heatmap(cm, annot=True, annot_kws={&quot;size&quot;: 16}, fmt=&#39;g&#39;,
linewidths=.5)
class_labels = [&#39;Not Rain&#39;, &#39;Rain&#39;]
axes.set_xlabel(&#39;Predicted&#39;, fontsize=12)

```

```

axes.set_ylabel('#39;Actual#39;;', fontsize=12)
xtick_marks = np.arange(len(class_labels)) + 0.5
ytick_marks = np.arange(len(class_labels)) + 0.5
axes.set_xticks(xtick_marks)
axes.set_xticklabels(class_labels, rotation=45)
axes.set_yticks(ytick_marks)
axes.set_yticklabels(class_labels, rotation=0)
axes.set_title('#39;KNN Confusion Matrix#39;;', fontsize=14, pad=20)
plt.show()
print('#39;KNN Classification Report#39;')
print(classification_report(y_val, y_pred, target_names=class_labels))

dtree_model = DecisionTreeClassifier()
dtree_model.fit(X_train, y_train)
dtree_model.predict(X_val)
dtree_model_score = dtree_model.score(X_val, y_val)

dtree_model_accuracy = round(dtree_model_score*100, 2)
print('"The classification accuracy of Decision Tree model is "'+
str(dtree_model_accuracy)+'"%"')
y_pred = dtree_model.predict(X_val)
cm = confusion_matrix(y_val, y_pred)
axes = sns.heatmap(cm, annot=True, annot_kws={'size': 16}, fmt='#39;g#39;;',
linewidths=.5)
class_labels = ['#39;Not Rain#39;;', '#39;Rain#39;']
axes.set_xlabel('#39;Predicted#39;;', fontsize=12)
axes.set_ylabel('#39;Actual#39;;', fontsize=12)
xtick_marks = np.arange(len(class_labels)) + 0.5
ytick_marks = np.arange(len(class_labels)) + 0.5
axes.set_xticks(xtick_marks)
axes.set_xticklabels(class_labels, rotation=45)
axes.set_yticks(ytick_marks)
axes.set_yticklabels(class_labels, rotation=0)
axes.set_title('#39;Decision Tree Confusion Matrix#39;;', fontsize=14, pad=20)
plt.show()
print('#39;Decision Tree Classification Report#39;')
print(classification_report(y_val, y_pred, target_names=class_labels))

adaboost_model = AdaBoostClassifier()
adaboost_model.fit(X_train, y_train)
adaboost_model.predict(X_val)
adaboost_model_score = adaboost_model.score(X_val, y_val)
adaboost_model_accuracy = round(adaboost_model_score*100, 2)
print('"The classification accuracy of XGBoost model is "'+
str(adaboost_model_accuracy)+'"%"')
y_pred = adaboost_model.predict(X_val)
cm = confusion_matrix(y_val, y_pred)

```

```

axes = sns.heatmap(cm, annot=True, annot_kws={'size': 16}, fmt='g',
linewidths=.5)

class_labels = ['Not Rain', 'Rain']

axes.set_xlabel('Predicted', fontsize=12)
axes.set_ylabel('Actual', fontsize=12)

xtick_marks = np.arange(len(class_labels)) + 0.5
ytick_marks = np.arange(len(class_labels)) + 0.5
axes.set_xticks(xtick_marks)
axes.set_xticklabels(class_labels, rotation=45)
axes.set_yticks(ytick_marks)
axes.set_yticklabels(class_labels, rotation=0)
axes.set_title('XGBoost Confusion Matrix', fontsize=14, pad=20)
plt.show()
print('XGBoost Classification Report')
print(classification_report(y_val, y_pred, target_names=class_labels))

rforest_model = RandomForestClassifier()
rforest_model.fit(X_train, y_train)
rforest_model.predict(X_val)
rforest_model_score = rforest_model.score(X_val, y_val)
rforest_model_accuracy = round(rforest_model_score*100, 2)
print('The classification accuracy of Random Forest model is ' +
str(rforest_model_accuracy) + '%')
y_pred = rforest_model.predict(X_val)
cm = confusion_matrix(y_val, y_pred)
axes = sns.heatmap(cm, annot=True, annot_kws={'size': 16}, fmt='g',
linewidths=.5)
class_labels = ['Not Rain', 'Rain']
axes.set_xlabel('Predicted', fontsize=12)
axes.set_ylabel('Actual', fontsize=12)
xtick_marks = np.arange(len(class_labels)) + 0.5
ytick_marks = np.arange(len(class_labels)) + 0.5
axes.set_xticks(xtick_marks)
axes.set_xticklabels(class_labels, rotation=45)

axes.set_yticks(ytick_marks)
axes.set_yticklabels(class_labels, rotation=0)
axes.set_title('Random Forest Confusion Matrix', fontsize=14, pad=20)
plt.show()
print('Random Forest Classification Report')
print(classification_report(y_val, y_pred, target_names=class_labels))

```

## HTML:

```
<form name="form1" method="post">
```

```
<div class="row">
<div class="col-md-6">
Name
</div>
<div class="col-md-4">
<input type="text" name="name" class="form-control p-4
datetimepicker-input" placeholder="" />
</div>

</div>
<br>
<div class="row">
<div class="col-md-6">
Location
</div>
<div class="col-md-4">
<input type="text" name="location" class="form-control p-4
datetimepicker-input" placeholder="" />
</div>

</div>
<br>
<div class="row">
<div class="col-md-6">
Mobile No.
</div>
<div class="col-md-4">
<input type="text" name="mobile" maxlength="10"
class="form-control
p-4 datetimepicker-input" placeholder="" />
</div>

</div>
<br>
<div class="row">
<div class="col-md-6">
Email
</div>
<div class="col-md-4">
<input type="text" name="email" class="form-control p-4
datetimepicker-input" placeholder="" />
</div>

</div>
<br>
```

```
<div class="row">
<div class="col-md-6">
Username
</div>
<div class="col-md-4">
<input type="text" name="uname" class="form-control p-4
datetimepicker-input" placeholder="" />

</div>

</div>
<br>
<div class="row">
<div class="col-md-6">
Password
</div>
<div class="col-md-4">
<input type="password" name="pass" class="form-control p-4
datetimepicker-input" placeholder="" />

</div>

</div>
<br>
<div class="row">
<div class="col-md-6">
Re-type Password
</div>
<div class="col-md-4">
<input type="password" name="cpass" class="form-control p-4
datetimepicker-input" placeholder="" />

</div>

</div>
<br>

<div class="row">

<div class="col-md-6">

</div>

<div class="col-md-4">
<button class="btn btn-primary btn-block" type="submit"
style="height:
47px; margin-top: -2px;" onClick="return
validate()">Register</button>
</div>
```

```
</div>

</form>

<span style="color:#FF0000">{{msg}}</span>
```

### Connect with MySQL:

```
mydb = mysql.connector.connect (
host="localhost",
user="root",
password="",
charset="utf8",
database="rainfall_prediction"

)

#Login
def login():
msg=""

if request.method=="POST":
uname=request.form["uname"]
pwd=request.form["pass"]

cursor = mydb.cursor()
cursor.execute("SELECT * FROM rf_register WHERE uname = %s AND pass = %s",
(uname, pwd))
account = cursor.fetchone()
if account:
session["username"] = uname
return redirect(url_for("test_data"))
else:
msg = "Incorrect username/password!"
return render_template("login.html",msg=msg)

#Registration
def register():
msg=""
act=request.args.get("act")
if request.method=="POST":
name=request.form["name"]
location=request.form["location"]
mobile=request.form["mobile"]
email=request.form["email"]
uname=request.form["uname"]
```

```

pass1=request.form[&#39;pass&#39;]

mycursor = mydb.cursor()

now = datetime.datetime.now()
rdate=now.strftime(&quot;%d-%m-%Y&quot;);

mycursor.execute(&quot;SELECT count(*) from rf_register where uname=%s&quot;;, (uname,))

cnt = mycursor.fetchone()[0]

if cnt==0:
mycursor.execute(&quot;SELECT max(id)+1 FROM rf_register&quot;);
maxid = mycursor.fetchone()[0]
if maxid is None:
maxid=1

sql = &quot;INSERT INTO
rf_register(id,name,location,mobile,email,uname,pass,create_date) VALUES (%s, %s, %s,
%s, %s, %s, %s, %s)&quot;;
val = (maxid,name,location,mobile,email,uname,pass1,rdate)
mycursor.execute(sql, val)
mydb.commit()
#print(mycursor.rowcount, &quot;Registered Success&quot;;)
msg=&quot;sucess&quot;;
#if mycursor.rowcount==1:
return redirect(url_for(&#39;register&#39;;, act=&#39;1&#39;))
else:
msg=&#39;User Already Exist!&#39;;
return render_template(&#39;register.html&#39;;, msg=msg, act=act)

```

## Test Result:

```

def test_data():
act=&quot;&quot;;
res=&quot;&quot;;
uname=&quot;&quot;;

```

```

if '&#39;username&#39; in session:
    uname = session['&#39;username&#39;]
    if uname is None:

    return redirect(url_for('&#39;login&#39;))
    mycursor = mydb.cursor()
    mycursor.execute('&quot;SELECT * FROM rf_register where uname=%s&quot;',(uname,))
    data = mycursor.fetchone()
    name=data[1]

if request.method=='&#39;POST&#39;:
    min_temp=request.form['&#39;min_temp&#39;]
    max_temp=request.form['&#39;max_temp&#39;]
    rain=request.form['&#39;rain&#39;]
    gust_dir=request.form['&#39;gust_dir&#39;]
    gust_speed=request.form['&#39;gust_speed&#39;]
    hum1=request.form['&#39;hum1&#39;]
    hum2=request.form['&#39;hum2&#39;]
    pres1=request.form['&#39;pres1&#39;]
    pres2=request.form['&#39;pres2&#39;]
    temp1=request.form['&#39;temp1&#39;]
    temp2=request.form['&#39;temp2&#39;]
    df = pd.read_csv('&quot;static/dataset/weather_test.csv&quot;')
    x=0
    mt=float(min_temp)
    mx=float(max_temp)
    rain1=float(rain)
    for rr in df.values:
        if rr[2]>mt1 and rr[2]<=mt2 and rr[3]>mx1 and rr[3]<=mx2 and rr[4]>r1 and
        rr[4]<=r2 and rr[7]==gust_dir and rr[8]>gs1 and rr[8]<=gs2:
            if rr[13]>hm1 and rr[13]<=hm2 and rr[14]>hm3 and rr[14]<=hm4 and rr[15]>pr1
            and rr[15]<=pr2 and rr[16]>pr3 and rr[16]<=pr4:
                if rr[19]>tm1 and rr[19]<=tm2 and rr[20]>tm3 and rr[20]<=tm4:
                    x+=1

```



```
print(x)
act="1"
if x>0:
    res="Yes"
else:
    res="No"
```

[Video Demo link](#)

[Github link](#)